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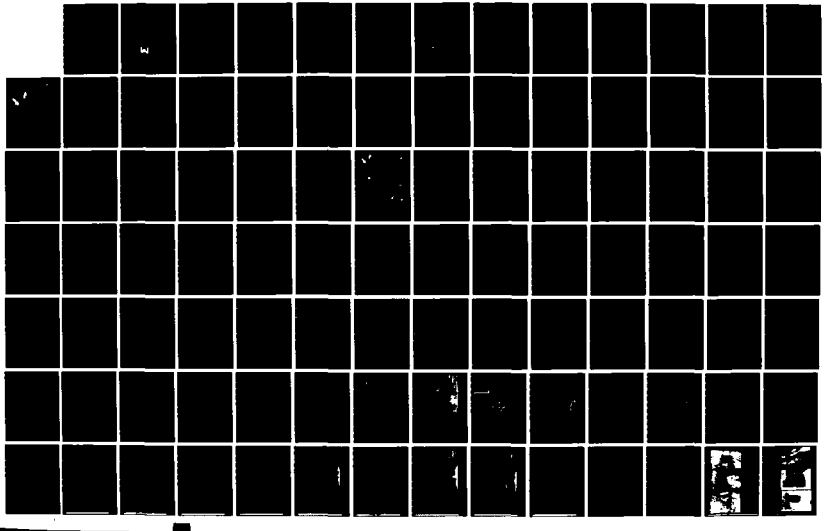

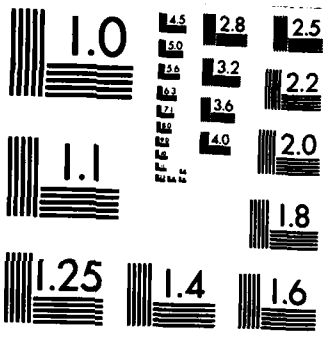

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CONNECTICUT RIVER BASIN
SANDISFIELD, MASSACHUSETTS

ABBEY LAKE DAM
MA 00305

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

FEBRUARY 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Cinnecticut River Basin
Sandisfield, Massachusetts
Buck River (Tributary to Clam River)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is an earthfill embankment about 210 ft. long and 39.5 ft. high and has a concrete principle spillway which maintains the recreation pool level and controls the release of stored floodwater, and a 50 ft. wide earth excavated emergency spillway channel around the left abutment. The dam appears to be in general good condition.The classification of the dam is small in size and the hazard potential is high.

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ABBEY LAKE DAM

MA 00305

CONNECTICUT RIVER BASIN
SANDISFIELD, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PORGRAM
PHASE I INSPECTION REPORT

Identification No.:	MA 00305
Mass. D.P.W. No.:	1-2-260-10
Name of Dam:	Abbey Lake
Town:	Sandisfield
County and State:	Berkshire County, Massachusetts
Strear:	Buck River (Tributary to Clam River)
Date of Inspection:	November 1, 1979

BRIEF ASSESSMENT

The Abbey Lake Dam, No. MA 00305, is located on the Buck River a tributary to the Clam River, in the Town of Sandisfield, Massachusetts. The dam site is approximately two miles upstream of the Village of Montville and is located off West Street. The dam is a mutiple purpose recreation and flood protection facility which is owned by the Massachusetts Division of Water Resources. It was designed by the U.S. Department of Agriculture, Soil Conservation Service. The dam was completed in 1967. The dam is an earthfill embankment about 210 feet in length, and 39.5 feet in height and has a reinforced concrete principle spillway which maintains the recreation pool level and controls the release of stored floodwater, and a 50 foot wide earth excavated emergency spillway channel around the left abutment. The dam impounds approximately 154 acre feet at the normal pool elevation of 1462.2 feet MSL and 392 acre feet at emergency spillway crest elevation of 1,472 feet MSL.

Te dam and appurtenances were found to be in generally good condition. However, since the heavy legume ground cover on the dam embankment prevented a thorough inspection for seepage, slippage, and animal burrows, the dam has been rated FAIR. Some maintenance and minor remedial work is required as listed in Section 7.

The test flood for this dam has been determined to fall within a range with one-half the Probable Maximum Flood being a minimum requirement, and the Probable Maximum Flood being the maximum requirement, based on a classification of SMALL size and HIGH hazard. The drainage area is 1.75 square miles and the test flood inflow (PMF) is 4,500 cfs. Routing the test flood through the reservoir, with the initial pool level at the high stage recreation pool level, resulted in an outflow of 3,180 cfs from the dam. The Abbey Lake dam has a combined spillway capacity of 2900 cfs which is equivalent to 91 percent of the PMF test flood outflow with the water level at the top of the dam. At test flood outflow, the depth of water overtopping the dam is 0.2 feet.

Prior to the assumed breach with the flood pool at top of dam, there is a threat to approximately eight (8) houses, two major highway bridges, and two secondary road crossings. Failure of the dam would pose a serious threat to approximately five (5) additional houses. The affects of a dam failure, therefore, add significantly to the damage anticipated at these locations.

The recommended remedial measures as listed in Section 7 including additional erosion protection along the right training dike of the emergency spillway, maintenance of the embankment vegetative cover to allow complete inspection and periodic operation of the pond drain sluice gate should be implemented within one year of receipt of this report by the owner.

John W. Powers
Massachusetts Registration 23106

This Phase I Inspection Report on Abbey Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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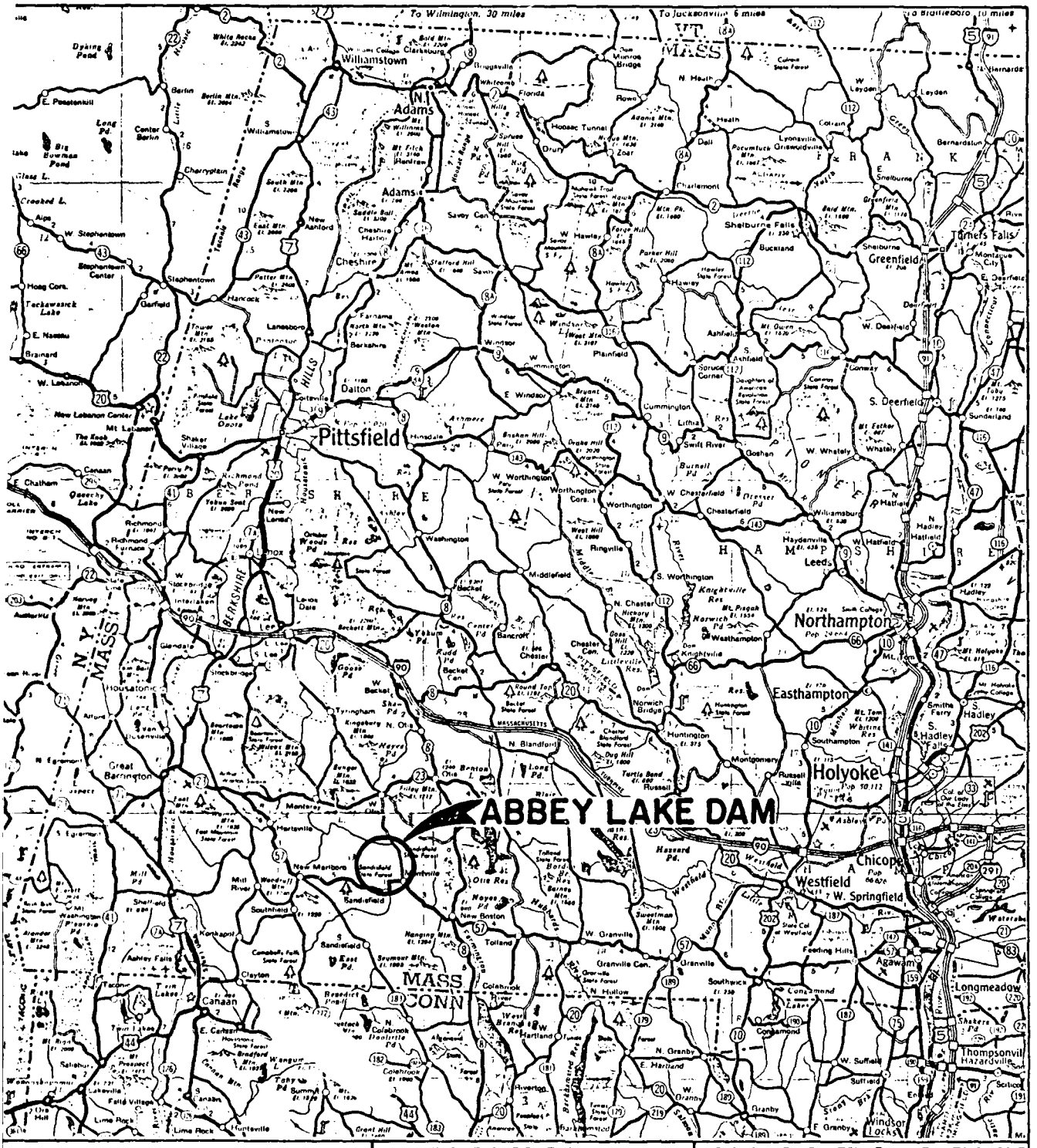

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SCALE IN MILES

MAP LOCATION

TIGHE & BOND / SCI CONSULTING ENGINEERS EASTHAMPTON, MASS.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCUS PLAN 1

ABBEY LAKE DAM (MA 00305)
BERKSHIRE COUNTY

SANDISFIELD
MASSACHUSETTS

			SCALE: AS NOTED
			DATE: FEBRUARY 1980

(e) Downstream Channel

The downstream channel is in good condition and free from vegetation growth, fallen trees, or other obstructions. Riprap protection along the sides of the channel was found to be in good condition.

3.2 Evaluation

The dam is generally in good condition with the following deficiencies noted:

a) The grass and legume growth on the embankments and top of dam are very dense and prevent a complete inspection of these portions of the dam.

b) The emergency spillway right training berm and right side discharge area lack adequate erosion protection.

c) The principal spillway riser structure trash rack assembly is not effective in trapping debris outside of the riser.

The interior of the riser structure was found to be free of any debris or blockage. The sluice gate operator appears to be in good condition, however, it was not operated as part of the inspection.

Personnel from the Massachusetts Division of Forests and Parks, who were present during the inspection, indicated that the sluice gate shaft had been replaced approximately three years ago after being bent while attempting to operate the sluice gate. Due to the past difficulty in operating the sluice gate, no routine operation of the gate is carried out.

A review of the annual inspection reports made by the Owner and S.C.S., indicates a continuing need to remove debris from the interior of the riser structure. Although at the time of this inspection the riser structure was free of any debris, the trash rack system was found to be identical to the West Lake Dam system. A large amount of debris was found inside of the West Lake riser structure. Based on the type of design and past routine S.C.S. inspection reports it can be concluded that the trash rack system is not very effective in trapping debris outside of the riser structure where it can be readily and easily removed.

2) Pond Drain Inlet Pipe

At the time of the inspection, the water level was at the normal recreation pool level. Therefore, the inlet pipe and headwall structure were submerged and not visible.

3) Outlet Conduit

The 36 inch diameter conduit was found in good condition. Four pipe joints were visible from the outlet end and all were found to have good alignment and were dry above the flow line. The interior of the conduit is in good condition with no visible spalling, cracking, or efflorscence.

4) Impact Basin

The impact basin was found to be in good condition with no visible spalling, cracking, or efflorescence. The structure was clear of debris with free unobstructed outflow to the downstream channel.

(d) Reservoir Area

The shore of the reservoir is generally steeply sloping woodland. It appears stable and in good condition as viewed from the dam embankment area.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

(a) General

The Abbey Lake dam, No. MA 00305 was in FAIR condition at the time of the inspection.

(b) Dam

1) Earth Embankment

The upstream slope above water level and the downstream slope were found to have a very dense cover of legumes and grass. No apparent movement, sloughing, slides or settlement was visible. The riprap protection along the upstream face was in good condition and extends up the embankment to an elevation of approximately 2 feet above the recreation pool level.

Both the left and right downstream toe areas were found to be dry with no visible seepage. The 10 inch foundation drain outlets were found to be flowing at a rate of approximately 2 GPM from the left side and 3 GPM from the right side.

2) Emergency Spillway

The emergency spillway channel is in fair condition. The left side of the earth excavated channel has a wet area with standing water ¼ to ½ inch deep approximately 50 feet downstream of the control section on the left side of emergency spillway embankment approximately 20 feet wide by 70 feet long. The entire channel is covered by a thick growth of legumes and grass. The channel itself was free of debris and did not have any overhanging trees or other channel obstructions.

The far downstream end of the right side training embankment was found to be approximately 1.7 feet above the floor of the channel. The training berm does not have any erosion protection other than the growth of grass and legumes. There is no erosion protection provided on the right side of the discharge end of the spillway channel where the flow would leave the channel and discharge down the embankment to the receiving stream below.

(c) Appurtenant Structures

1) Drop Inlet Principal Spillway

The principal spillway riser was found to be in good condition. The structure appeared to be structurally sound with no visible cracking, spalling, seepage, or efflorescence.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

The design data for the Abbey Lake dam provided by the Soil Conservation Service incudes hydrologic and hydraulic computations and summaries, structural calculations, a geological report, soil laboratory test data, embankment slope stability analyses, and other design information all contained within "Design Report" dated February 1965. The design of the dam and appurtenances is based primarily on a number of Soil Conservation Service Publications which are listed in the General Section of the Design Report.

This design data was reviewed and found to be substantially correct and valid. Therefore, it was used extensively in preparing Section 5 and Appendix D of this report.

2.2 Construction Data

"As Built" record drawings were available for the Abbey Lake dam. These drawings have been reviewed and found to show good agreement with the design drawings and visual inspection. The only item found not to agree with the record drawings was the extent of riprap protection on the upstream embankment. The extent of riprap observed during our inspection appears to exceed that called for on the drawings.

Appendix B contains copies of the important "as built" drawings. These copies have been made from originals provided by the Soil Conservation Service.

2.3 Operational Data

The dam is self regulating, therefore, no operational data is available. Under normal conditions the hydraulics of the principal spillway maintain a low level recreation pool.

2.4 Evaluation of Data

(a) Availability

Sufficient data is available to permit an evaluation of the dam when combined with findings of the visual inspection.

(b) Adequacy

There is sufficient design and construction data to permit an assessment of dam safety when combined with the visual inspection, past performance, and sound engineering judgment.

(c) Validity

Since the observations of the inspection team generally confirm the available data, a satisfactory evaluation for validity is indicated.

4) Gates: 24" sluice gate on pond drain inlet

5) Upstream channel:

a)	Principal Spillway:	Reservoir
b)	Emergency Spillway:	Grass and legume covered earth excavated channel. 140± ft. to control section

6) Downstream Channel:

a)	Principal Spillway:	Riprapped channel 200 ft. to natural stream channel through fairly steep narrow valley
b)	Emergency Spillway:	Grass and legume covered, earth excavated channel 254± ft. to wooded growth area discharging into natural stream channel 300 downstream off dam

(j) Regulating Outlets

The only regulated outlet from the dam is the pond drain which is controlled by a manually operated 24 inch sluice gate. This gate is located on the inside face of the pond side wall of the principal spillway riser structure with its invert at elevation 1444. The floor stand operator is located on the top of the principal spillway riser which can only be accessed by boat when the reservoir pool is above normal level. The gate is a Rodney Hunt, non seating head type, with a rising stem operator having the following identification:

52796-2
S-2600A

The gate is normally in the closed position, and only rarely operated for maintenance checks.

2) Length - 210± ft.

3) Height - 39.5 ft.

4) Top Width - 14 ft.

5) Side Slopes - 3 hor. on 1 vert. both faces, with 8 ft. horizontal berm at elev. 1467 of upstream embankment

6) Zoning - Homogeneous, semi-pervious silty sand

7) Impervious Core - None

8) Cutoff - Variable width and depth, semi-pervious silty sand earthfill

9) Grout curtain - None

(h) Diversion and Regulating Tunnel

Not applicable

(i) Spillways

1) Type:

a)	Principal spillway:	Reinforced concrete drop inlet
b)	Emergency spillway:	Grass and legume covered, earth excavated channel with level control section

2) Length of weir:

a)	Pond drain inlet:	24" diameter pipe
b)	Low stage inlet:	Rectangular orifice 27" wide x 12" high
c)	High tage inlet:	4 @ 4.5 ft. = 18 ft.
d)	Emergency spillway:	50 ft.

3) Crest Elevation

a)	Pond drain inlet:	1444.0
b)	Low stage inlet:	1462.2
c)	High stage inlet:	1468.3
d)	Emergency spillway:	1472.0

8) Top of dam - 1479

9) Test flood surcharge - 1479.2 (dam overtopped by 0.2 ft.)

(d) Reservoir (Length in feet)

1) Normal pool - 2120± ft.

2) Flood Control pool - 2960± ft.

3) Emergency spillway crest pool - 2860± ft.

4) Top of dam - 3160± ft.

5) Test flood pool - 3160± ft.

(e) Storage (acre-feet)

1) Normal pool - 154

2) Flood control pool - 546

3) Spillway crest pool

a) Low stage crest - 154

b) High stage crest - 387

c) Emergency spillway - 546

4) Top of dam - 889

5) Test flood pool - 900

(f) Reservoir Surface (acres)

1) Normal pool - 36

2) Flood-control pool - 45

3) Spillway crest

a) Low stage crest - 36

b) High stage crest - 41.5

c) Emerg. spillway crest - 45

4) Test flood pool - 53

5) Top of dam - 52.7

(g) Dam

1) Type - Earth embankment

The Buck River, on which Abbey Lake dam is located, originates in the northern-most portion of the drainage area from a swamp located on the southerly side of Cronk Road.

(b) Discharge at Dam Site

Normal discharge at the site is via the low and high stage inlets to the principal spillway and through the 36 inch diameter outlet conduit to the downstream channel. If flood flows occur of sufficient magnitude and duration to fill the flood water storage available, then excess flow will be discharged around the dam via the emergency spillway channel.

1) Outlet works (conduit) size 36 inch, Invert Elev. 1442 and Discharge Capacity 184 cfs.

2) Maximum known flood at dam site - Unknown

3) Ungated spillway capacity (principal and emergency) at top of dam - 2900 cfs at elev. 1479.

4) Ungated spillway capacity at test flood elevation - 2900 cfs at elev. 1479.

5) Gated spillway capacity at normal pool elevation: None.

6) Gated spillway at test flood elevation: None

7) Total spillway capacity at test flood elevation - 2900 cfs at elev. 1479 (same as #4)

8) Total project discharge (principal and emergency spillway) at top of dam - 2900 cfs at elev. 1479 (same as #3)

9) Total project discharge at test flood elevation - 3180 cfs at 1579.20 elev. (dam overtopped by 0.2 feet)

(c) Elevation (ft. above MSL, NGVD)

1) Streambed at toe of dam - 1439.5±

2) Bottom of cutoff - 1438.5 (low point)

3) Maximum tailwater - Unknown

4) Normal pool - 1462.2

5) Full flood control pool - 1472

6) Spillway crest - crest elev. = 1472 ungated

7) Design surcharge-1473.7

(f) Operator

The operation of the Abbey Lake dam is the responsibility of the Commonwealth of Massachusetts, Department of Environmental Management, Division of Forests and Parks. The regional office responsibile for the dam is as follows:

Commonwealth of Massachusetts
Department of Environmental Management
Division of Forests and Parks
Pittsfield State Forest
Cascade Street
Pittsfield, Massachusetts 01201

Mr. Douglas G. Poland is the Regional Supervisior. The telephone number in Pittsfield, Mass., is 413-442-8992.

(g) Purpose of Dam

The Abbey Lake dam is a multiple purpose dam which maintains a low level recreation pool and provides flood storage to reduce downstream flooding from the dam's drainage area. Stored flood water is gradually released through low and high stage inlets of the principal spillway.

(h) Design and Construction History

The Abbey Lake dam was designed by the U.S. Department of Agriculture, Soil Conservation Service. It was completed in the fall of 1967 and has been in operation since that time. There have been no modifications to the dam since the original construction was completed, however, slight modifications to the original design were required during construction. These modifications consisted primarily of rotating the alignment of the dam approximately 5° from the original layout and requiring additional depth of excavation along the cutoff trench to reach bedrock material. The bedrock which was encountered required grouting of the cracks and fissures to reduce its permeability.

(i) Normal Operation Procedure

The Abbey Lake dam is normally self regulating with the only controlled outlet being the pond drain. This outlet is operated only as part of infrequent maintenance checks.

1.3 Pertinent Data

(a) Drainage Area

The drainage area for the Abbey Lake dam covers approximately 1.75 square miles. Nearly all of the drainage area is mountainous type woodland with only a small amount of open area along Hubbard Road. There is some development of farms and homes within the watershed area primarily off of Hubbard Road and Cronk Road.

downstream of the dam. The side slopes of the spillway excavation are 3 horizontal to 1 vertical. The maximum depth of excavation appears to be approximately 13 feet and is just upstream of the control section. The control section is approximately 7 feet below the top of the dam.

4) Foundation and Embankment Drainage (See page B-5)

A trench drain of clean sand and gravel extends into the foundation materials and the silty sand material of the downstream toe. The trench drain extends from the principal spillway left about 52 feet and right about 108 feet, with a 10 inch diameter perforated CMP drain pipe extending the full length of the drain trench. The 10 inch diameter trench drain outlet pipes discharge into the impact basin structure at the outlet of the principal spillway.

A blanket drain extends from the foundation trench drain to the downstream toe of the dam. The blanket drain is located along the principal spillway outlet conduit and extends out under the right embankment of the dam. The blanket drain appears on the record drawings to extend from the principal spillway outlet conduit to a distance of approximately one-half the length of the right downstream embankment. The record drawings do not indicate a blanket drain to the left of the outlet conduit.

(c) Size Classification

The dam's maximum impoundment (computed to the top of the dam) of about 889 acre-feet and structural height of 39.5 feet place it in a SMALL size classification.

(d) Hazard Classification

The hazard potential classification for this dam is HIGH because of the potential for loss of more than a few lives and property damage which may occur in the event of a dam failure. There is a high potential for severely damaging about 5 homes with attendant probable loss of more than a few lives as well as two major highway bridges and two secondary road culverts.

(e) Ownership

The Abbey Lake Dam is owned by the Commonwealth of Massachusetts, Department of Environmental Management, Divsion of Water Resources. The address is as follows:

Commonwealth of Massachusetts
Department of Environmental Management
Division of Water Resources
100 Cambridge Street
Boston, Massachusetts 02202
Telephone No.: 617-727-3170

1442.0. The low stage orifice is located on the upstream face and measures 12 inches high by 27 inches wide with an invert elevation of 1462.2. The high stage overflow weirs are formed by the tops of the riser section walls and have a total length of 18 feet with a crest elevation of 1468.3. There are three anti-vortex walls placed perpendicular to and across the top of the weir walls with a solid concrete platform bridging the two upstream anti-vortex walls as the sluice gate operator stand support. The downstream half of the structure has a piece of grating as a walkway and the low and high stage outlets are protected with trash racks consisting of galvanized angle iron.

The sluice gate which controls the 24 inch diameter pond drain is, according to the record drawing, a 24 inch diameter Rodney Hunt sluice gate, Model 180, mounted on a 9 inch deep Type F wall thimble. The gate is operated by a rising stem, manual crank operated floor stand located on the top of the riser structure.

The pond drain pipe consists of about 54 feet of 24 inch diameter A.B.B.C.C.M.P. conduit with a reinforced concrete inlet structure. This conduit enters the riser structure through the upstream face.

The principal spillway structure has a 36 inch diameter outlet conduit to an impact basin located at the downstream toe of the dam. The 36 inch diameter conduit consists of reinforced concrete pipe with a continuous concrete bedding which is founded on bedrock. There are four reinforced concrete anti-seep collars placed along the conduit through the dam embankment. The pipe has an inlet elevation of 1442.0 and an outlet elevation of 1437.5 with an overall length of 143.33 feet providing a slope of 0.031 ft/ft.

The impact basin is constructed of reinforced concrete and is approximately 20 feet long x 15 feet wide with a reinforced concrete baffle spanning across the flow path to dissipate the energy from the high velocity outlet flow from the 36 inch diameter conduit during flood flows.

3) Emergency Spillway (See pages B-3, B-4)

The emergency spillway consists of a legume covered earth channel excavated through natural ground on the left abutment of the dam. The spillway channel has a control section approximately at elevation 1472.0 which is 50 feet wide and 30 feet long. The spillway approach channel has a slope of 0.02 ft/ft and is approximately 140 feet in length. The emergency spillway approach channel curves about 55° to the right towards the control section. The control section is level at elevation 1472 for a distance of about 30 feet. The discharge channel slopes downward at 0.035 ft/ft for a distance of about 254 feet where it discharges onto original ground

to the Clam River and Farmington River respectively. The dam and impoundment is located off of West Street and is about 2.3 miles from the center of Sandisfield.

The dam is located on the U.S.G.S. Monterey, Mass., quadrangle at longitude N42°-08'-05" and latitude W73°-09'-09". Refer to the location plans, and Appendix B for additional information.

(b) Description of Dam & Appurtenances

The dam consists of an earthfill embankment, a principal spillway consisting of a reinforced concrete drop inlet structure having a two stage riser section, a 36-inch diameter reinforced concrete outlet conduit, and a reinforced concrete impact basin at the conduit outlet. An emergency spillway is located on the left abutment and consists of a legume covered channel, excavated in natural ground.

1) Embankment (See pages B-3, B-4, B-17)

The following information has been taken from the As-Built Drawings dated 1965.

The dam embankment is approximately 210 feet long and has a maximum structural height of approximately 39.5 feet. The upstream slope is 3 horizontal on 1 vertical and has an 8 foot berm (horizontal section) at elev. 1467. The downstream slope is 3 horizontal on 1 vertical, and the width of the top of the dam is 14 feet. The upstream slope surface is covered with dumped riprap to a level of approximately 2 feet above the recreation pool water level.

The earthfill material is a homogeneous type, consisting of a silty sand (SM using Unified Soil Classification System). A cutoff trench consisting of fine silty sand is located beneath the embankment along the centerline of the dam.

The top, downstream embankment, and upper portion of the upstream embankment are covered with a mixture of legume and grass growth.

2) Principal Spillway (See page B-6, B-7, B-8, B-9, B-15, B-18)

The principal spillway consists of a reinforced concrete drop inlet structure with a sluice gate controlled inlet pipe at invert elevation 1444.0 for the pond drain, an uncontrolled orifice inlet at invert elevation 1462.2 for the low stage pond outlet, and uncontrolled overflow weirs at elevation 1468 3 for the high stage pond outlet.

The riser structure is 29 feet 4 inches from the base of the foundation to the top of the structure. The inside dimensions are 3 feet x 10 feet with 12 inch thick reinforced concrete walls. The inside bottom elevation of the riser structure is

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

ABBEY LAKE DAM

SECTION 1

PROJECT INFORMATION

1.1 General

(a) Authority

Public Law 92-367, august 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Tighe & Bond/SCI has been retained by the New England Division to inspect and report on selected dams in Massachusetts. Authorization and notice to proceed were issued to Tighe & Bond/SCI under a letter of October 24, 1979 from Colonel William E. Hodgson, Jr., Corps of Engineers. Contract No. DACW-33-80-C-0005 has been assigned by the Corps of Engineers for this work.

(b) Purpose

1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-federal interests.

2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-federal dams.

3) Update, verify, and complete the National Inventory of Dams.

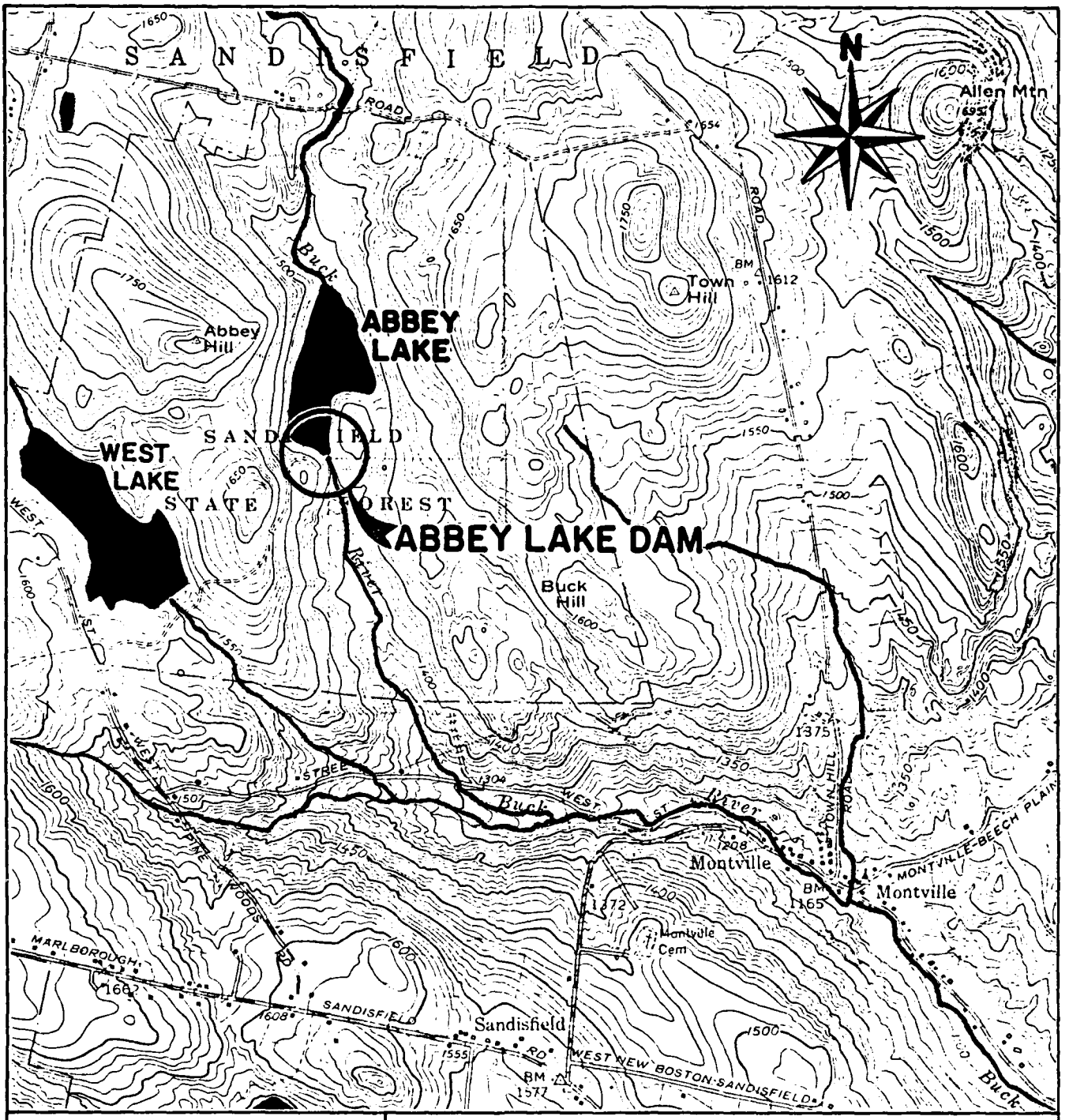
(c) Scope

The program provides for the inspection of non-federal dams in the high hazard potential category based upon location of the dams, and those dams in the significant hazard potential category believed to represent an immediate danger based on condition of the dams.

1.2 Descripton of Project

(a) Location

The Abbey Lake Dam is located within the Town of Sandisfield, Massachusetts, about two miles upstream from the Village of Montville. The dam is located on the Buck River which is a tributary



-SCALE-

1000' 0 1000' 2000' 3000'

FROM: U.S.G.S. MONTEREY, OTIS, SOUTH SANDISFIELD, AND TOLLAND CENTER, MASS. QUADRANGLE MAPS

QUADRANGLE LOCATION

TIGHE & BOND / SCI CONSULTING ENGINEERS EASTHAMPTON, MASS.	U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCUS PLAN 2

ABBEY LAKE DAM (MA 00305)
BERKSHIRE COUNTY

SANDISFIELD
MASSACHUSETTS

SCALE: AS NOTED

DATE: FEBRUARY 1980

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

(a) General

No written operational procedures are available for this dam. The dam is normally self regulating. The sluice gate on the pond drain in normally in the closed position and is not routinely operated.

(b) Description of Warning System in Effect

There is no written warning system in effect.

4.2 Maintenance Procedures

(a) General

An annual inspection is made by the Soil Conservation Service and recommendations resulting from this inspection are implemented by the Massachusetts Division of Forests and Parks.

Typical maintenance items assigned to the Division of Forests and Parks include liming and fertilizing, mowing, clearing of accumulated debris, etc.

(b) Operational Facilities

Discussions with the Division of Forests and Parks personnel indicated that the sluice gate for the pond drain is not routinely operated. There are no other facilities which require operation.

4.3 Evaluation

The very dense growth of grass and legumes on the dam embankments prevents complete inspection of these features. The embankment should be maintained so as to allow complete annual technical inspections of the dam and appurtenances. The sluice gate for the pond drain should be operated at least annually, and maintained well lubricated to prevent corrosion and maintain the operator in an operable condition. Additional emphasis on routine maintenance will assist the owner in assuring the long term utility of the dam.

A formal, written downstream emergency flood warning system should be developed for this dam.

SECTION 5 - EVALUATION OF HYDRAULIC/ HYDROLOGIC FEATURES

5.1 General

Abbey Lake Dam, No. MA 00305, is a multiple-purpose recreation and floodwater storage facility which was designed by the Soil Conservation Service (SCS), as part of the overall Clam River flood protection project.

The dam is located on the Buck River about 2 miles upstream of the Village of Montville in the Town of Sandisfield, Massachusetts. The dam is about 3.8 miles upstream of the confluence of the Buck River with the Clam River and 5.7 miles upstream of the confluence of the Clam River with the Farmington River in the Town of New Boston, Massachusetts.

The drainage area upstream of the dam is approximately 1.75 square miles (1,120 acres) and consists mainly of wooded, mountainous terrain.

Development within the watershed is very limited and consists of approximately 14 structures which appear on the U.S.G.S. quadrangle sheet.

The dam itself is about 210 feet long and 39.5 feet high, and is a homogeneous earthfill embankment. The facility has a principal spillway which maintains a low stage recreation pool and discharges all normal stream flows via a 36-inch diameter conduit through the dam. An emergency spillway, consisting of a 50 foot wide earth channel, excavated in natural soil with a legume and grass cover, carries flood flows which exceed the storage capacity of the impoundment around the dam to the downstream channel.

5.2 Design Data

The Abbey Lake dam and impoundment area has been designed by the S.C.S. to retard a 100 year frequency storm without discharge occurring in the emergency spillway. The calculations included in the S.C.S Design Report include storage vs. elevation, stage discharge curves for the combined spillways, and routing of the 100 year frequency storm through the reservoir. These calculations are dated 1964 and 1965.

The S.C.S. has established the elevation of the low stage outlet as 1462.2 which provides 154 acre-feet of storage including 3 acre-feet of sediment storage. The high stage storage has been set at elevation 1468.3 providing an additional 233 acre-feet of storage above the low stage inlet, and the emergency spillway control section set at elevation 1472 providing an additional 159 acre-feet of storage above the high stage inlet, resulting in a total flood storage pool of 392 acre-feet.

5.3 Experience Data

No records of flow or stage are known to be available for the Abbey Lake Dam.

5.4 Test Flood Analysis

The selection of the test flood is based on the Corps of Engineers, "Recommended Guidelines for Safety Inspection of Dams," dated November 1976. These guidelines state that dams classified as "SMALL" in size, and "HIGH" in hazard potential be tested against a flood ranging in magnitude from one-half of the "Probable Maximum Flood" to the full "Probable Maximum Flood" depending upon the degree of downstream hazard based on a dam failure analysis.

The determination of the PMF for the Abbey Lake dam is based on the Corps of Engineers "Preliminary Guidance for Estimating Maximum Probable Discharges in Phase I Dam Safety Inspection" dated March 1978. The guide curves provided cover drainage areas as small as 2.0 square miles, whereas, the Abbey Lake dam drainage area is only 1.75 square miles. Due to the non-availability of data for a drainage area of this size, an extrapolation of the guidance curve has been used.

Graphically extending the guidance curve results in a unit discharge of 2,575 cfs per square mile of drainage area which results in a PMF test flood of 4,500 cfs for the Abbey Lake Dam.

The purpose of the this Phase I investigation is to assess the dam's overtopping potential and its ability to store and/or discharge the test flood. This requires determining the storage characteristics of the impoundment area and the stage vs. discharge characteristics of the spillway. The SCS design report tabulates all of this data; and our review has determined the information to be substantially correct and valid, therefore, as noted in the computations included in Appendix D, this information has been utilized in performing the test flood analysis.

The test flood has been routed through the reservoir using the iteration process as outlined in the Corps of Engineers, "Preliminary Guidance for Estimating Probable Maximum Discharges in Phase I Dam Safety Inspections." The results of routing the test flood through the reservoir indicate that the storage capacity of the impoundment area will reduce the test flood inflow of 4,500 cfs to a reservoir outflow of approximately 3,180 cfs. This assumes that the level of the recreation pool is at elevation 1468.3 at the start of the storm, and the entire flood storage volume is available. Elevation 1468.3 is the crest elevation of the high stage overflow weirs.

The combined spillways have a discharge capacity with the water level at the top of the dam of 2,900 cfs. This is 91% of the calculated test flood outflow from the reservoir after routing. Therefore, the dam would be overtopped by about 0.2 ft. at PMF.

With a capacity to discharge approximately 91 percent of the full PMF test flood, the dam is concluded to have adequate spillway capacity.

5.5 Dam Failure Analysis

A dam failure analysis using the procedures in the Corps of Engineers, "Rule of Thumb Guidance for Estimating Downstream Failure Hydrographs" dated April 1978, was performed for the Abbey Lake dam. The assumed conditions are as follows:

1. Water level prior to breach is at top of dam elevation.

2. Stream flow at time of breach is PMF for the reach in question.

3. Stream flow at confluences is PMF for tributary watershed.

For an assumed breach equal to 40 percent of the dam width computed at half height, the breached width is approximately 53 feet. The resulting dam failure flow using a water height of 36.5 feet is 19,650 cfs.

The first damage area impacted by dam failure flow is directly downstream of the dam. The test flood flow prior to the dam breach occurring is 2900 CFS resulting in a river stage of about 4.5 feet. The dam failure flow is 19,650 CFS resulting in a river stage of about 9 feet. There are no structures or development directly downstream of the dam, therefore, any damage will not be significant.

The second damage area impacted by dam failure flow is at the crossing of West Street about 4,600 feet downstream of the dam. There is one (1) concrete box culvert at this location. Prior to dam breach, the test flood flow is 2900 CFS resulting in a river stage of about 4.5 feet. The culvert has a surcharged capacity of 212 CFS, therefore, it will be inundated and the roadway overtopped. The dam failure attenuated flow is 17,400 CFS resulting in a river stage of about 8 feet. This will increase the depth of flow over the roadway by about 4 feet and significantly increase the probability of severe damage to the roadway.

The third damage area impacted by dam failure flow is a second crossing of West Street about 6,600 feet downstream of the dam. There is one (1) culvert at this location. Tributary flow from the West Lake drainage area as well as additional drainage area downstream of both Abbey Lake and West Lake converges with the channel just upstream of this location. Prior to dam breach, the test flood flow is 8,700 CFS resulting in a river stage of about 7 feet. The culvert has a surcharged capacity of 842 CFS, therefore, it will be inundated and the roadway overtopped. The dam failure attenuated flow is 22,400 CFS resulting in a river stage of about 10 feet. This will increase the depth of flow over the roadway by about 3 feet and significantly increase the probability of severe damage to the roadway.

The fourth damage area impacted by dam failure flow is the crossing of Route 57 about 9,600 feet downstream of the dam. There is a steel beam, single span bridge at this location. Prior to dam breach, the test flood flow is 8,700 CFS resulting in a river stage of about 11 feet.

The bridge has a low cord height of 5 feet above the stream channel and a surcharged capacity of 1765 CFS, therefore, it will be inundated and the roadway overtopped. There are three (3) houses located upstream of the bridge which are less than 10 feet above the stream channel. These houses will be flooded by about 3 feet. The dam failure attenuated flow is 21,200 CFS resulting in a river stage of about 14 feet. This will increase the depth of flow over the roadway by about 3 feet, increase the flooded depth of the three (3) houses flooded by prefailure flow to a total depth of 6 feet and flooding one (1) additional house by about 2 feet.

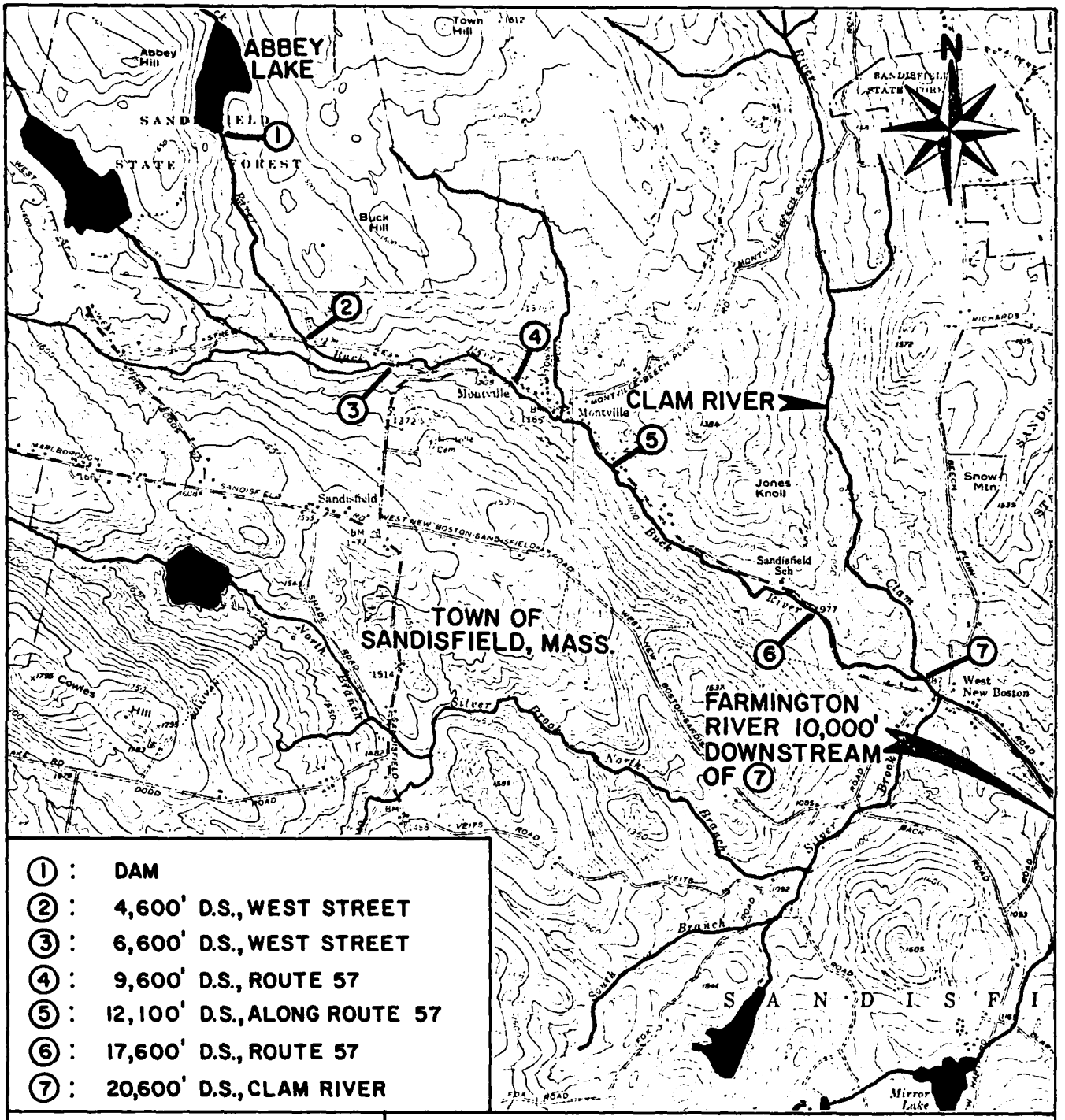
The fifth damage area impacted by dam failure flow is the Village of Montville located along the South side of Route 57. Tributary flow from additional drainage area converges with the Buck River just upstream of this area. Prior to dam breach, the test flood flow is 11,700 CFS resulting in a river stage of about 5.5 feet. There are three (3) houses located within this reach which are only a few feet above the stream channel. These houses will be flooded by about 2 feet. The dam failure attenuated flow is 22,200 CFS resulting in a river stage of about 8 feet. The three (3) houses flooded by prefailure flow will be flooded to a depth of about 5 feet and two (2) additional houses will be flooded by about 3 feet. The Route 57 roadway embankment will not be overtopped by the dam failure flow.

The sixth damage area impacted by dam failure flow is a second crossing of Route 57 about 17,600 feet downstream of the dam. There is a steel beam, single span bridge at this location. Prior to dam breach, the test flood flow is 11,700 CFS resulting in a river stage of about 8 feet. The bridge has an estimated surcharged capacity of 2,000 CFS, therefore, it will be inundated and the roadway overtopped. The dam failure attenuated flow is 22,000 CFS resulting in a river stage of about 11 feet. This river stage will cause some spillage from the main channel along the South side of Route 57 and will flood one (1) house by about 2 feet.

The seventh damage area impacted by a dam failure is just upstream of the confluence of the Buck River with the Clam River. Tributary flow from the Buck River drainage area converges with the river channel at this location. Prior to dam breach, the test flood flow is 14,600 CFS resulting in a river stage of about 10.5 feet. There are two (2) houses which are less than 10 feet above the stream channel. These houses will be flooded by about 4 feet. The dam failure attenuated flow is 23,300 CFS resulting in a river stage of about 13 feet. This increases the flooding of the two (2) houses to a depth of about 6.5 feet and floods one (1) additional house to a depth of about 3 feet.

Downstream of the confluence with the Buck River, the prefailure test flood flow is 29,600 CFS resulting in a river stage of about 14.5 feet. The dam failure attenuated flow plus tributary area test flood flow is 38,300 CFS resulting in a river stage of about 15.5 feet. The 1 foot of additional river depth due to the dam failure flow would not significantly add to the potential for damage downstream of the confluence with the Clam River.

In summary, the dam failure flow in conjunction with the PMF test flood flows from the tributary drainage area, has a high potential for damaging about 5 homes with attendant probable loss of more than a few lives. In addition, the dam failure flow would significantly increase the probability of destruction of 2 primary roadway bridges and 2 secondary roadway culverts. Downstream of the confluence with the Clam River in New Boston the affects of a dam failure occurring during a PMF occurrence are negligible.



-SCALE-

1000' 0 1000' 2000' 3000' 4000' 6000'

FROM: USGS MONTEREY, OTIS, SOUTH SANDISFIELD, AND TOLLAND CENTER, MASS. QUADRANGLE MAPS

(4) QUADRANGLE LOCATIONS

TIGHE & BOND / SCI
CONSULTING ENGINEERS
EASTHAMPTON, MASS.

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND DOWNSTREAM HAZARD MAP

ABBEY LAKE DAM (MA 00305)
BERKSHIRE COUNTY

SANDISFIELD
MASSACHUSETTS

SCALE: AS NOTED

DATE: FEBRUARY 1980

PROBABLE DOWNSTREAM IMPACT BEFORE AND AFTER DAM FAILURE

Abbey Lake Dam MA 00305

Location	No. of Houses	Other Damage	Flow Rates		River Stage		Comments
			Before Failure	After Failure	Before Failure	After Failure	
1. Downstream of Dam	0	0	CFS 3180	CFS 19,650	FT. 4.5	FT. 9	No significant damage
2. 4,600' downstream @ West St.	0	1 culvert	3180	17,400	4.5	8	Before failure culvert inundated
3. 6,600' downstream @ West St.	0	1 culvert	9000	22,400	7	10	Before failure culvert inundated
4. 9,600' downstream @ Rt. 57	4	1 bridge	9000	21,200	11	14	Before failure bridge inundated, 3 houses flooded 3 ft.; after failure 3 houses flooded 6 ft., 1 house flooded 2 ft.
5. 12,100' downstream	5	--	12,000	22,200	5.5	8	Before failure 3 houses flooded 2 ft; after failure 3 houses flooded 5 ft; 2 houses flooded 3 feet
6. 17,900' downstream @ Rt. 57	1	1 bridge	12,000	22,000	8	11	Before failure bridge inundated; after failure 1 house flooded 2 ft.
7. 19,600' downstream, upstream of Clam River confluence	3	--	14,900	23,300	10.5	13	Before failure 2 houses flooded 4 ft; after failure 2 houses flooded 6.5 ft., 1 house flooded 3 ft.

Total number of houses flooded before failure = 8 Total number of houses flooded after failure = 13

SECTION 6 - EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observation

The visual inspection of the dam embankments did not identify any conditions indicating instability of the slopes. No settlement, sloughing, or piping was observed, and no cracking of the surface could be detected.

6.2 Design and Construction Data

a) Embankment

Analysis carried out during the design phase included an embankment slope stability analysis by the "Swedish Circle" method. Based on this analysis a 3 horizontal to 1 vertical embankment slope was utilized.

b) Appurtenant Structures

A review of the structural calculations for the design of the principal spillway structure and the outlet conduit revealed that these structures have been designed on the basis of sound engineering practice.

6.3 Post Construction Changes

There are no known post construction modifications to the Abbey Lake Dam.

6.4 Seismic Stability

The Abbey Lake dam is located in seismic zone 1. According to the recommended Corps of Engineers guidelines, a seismic analysis is not warranted.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

(a) Condition

The dam and its appurtenances are in FAIR condition.

(b) Adequacy of Information

There is sufficient design and construction data to permit an assessment of dam safety, however, due to the dense legume growth on the downstream face of the dam, a complete visual inspection of the dam was not possible. In general, available data, past performance of the dam and sound engineering judgement were sufficient to conduct the analysis presented in this report.

(c) Urgency

The recommendations and remedial measures described herein should be implemented by the owner within one year of receipt of this Phase I Inspection Report.

7.2 Recommendations

The recommendations of this Phase I investigation are that no additional studies are required.

7.3 Remedial Measures

The recommendations of this Phase I investigation are that the following remedial and/or maintenance items be carried out:

a. The upstream embankment above the riprap, the top, and the downstream embankment should be maintained.

b. The right training embankment and right discharge area of the emergency spillway channel lack erosion protection. Additional erosion protection should be provided.

c. Operate the pond drain sluice gate at least annually as a maintenance check and maintain the operator well lubricated.

d. Establish a monitoring plan for the project during periods of intense rainfall/flooding and prepare a formal written downstream warning system.

e. Continue the program of annual periodic technical inspections.

f. Determine the cause of the failure of the principal spillway riser trash rack to retain debris and implement corrective measures.

7.4 Alternatives

There are no meaningful alternatives to the above recommendations.

APPENDIX A

VISUAL CHECKLIST WITH COMMENTS

INSPECTION CHECK LIST

PARTY ORGANIZATION

OJECT Abbey Lake Dam - MA 00305

DATE 11/1/79

TIME 10:00 A.M.

WEATHER Sunny & Cool

W.S. ELEV. 1468+ U.S. ____ DN.S.

RTY: Tighe & Bond/SCI

John W. Powers, P.E., Proj. Manager

George H. McDonnell, P.E., Hydrology/Hydraulics

David M. Lenart, P.E., Civil

Edward A. Moe, P.E., Soils/Hydraulics

Omer H. Dumais, Jr., Civil

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	All project features were inspected by all party members		
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Owner's Representatives Present:

Raymond Curran, S.C.S.
Carl Curtin, Mass. Forests & Parks
Bob Rando, Mass. Forest & Parks

INSPECTION CHECK LIST

OJECT Abbey Lake Dam DATE 11/1/79

OJECT FEATURE _____ NAME _____

SCIPLINE _____ NAME _____

AREA EVALUATED	CONDITIONS
EMBANKMENT	
Crest Elevation	Measured 12.4 ft. above W.L.
Current Pool Elevation	1468.1-W.L. 2" below overflow weirs
Maximum Impoundment to Date	Unknown
Surface Cracks	None visible - heavy grass cover would not reveal small cracks if present
Pavement Condition	N/A
Movement or Settlement of Crest	None apparent
Lateral Movement	None apparent
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None apparent
Trespassing on Slopes	None apparent
Vegitation on Slopes	Heavy grass and legume cover
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	None visible
Unusual Movement or Cracking at or near Toes	None visible
Unusual Embankment or Downstream Seepage	None - both left and right toe areas were dry
Piping or Boils	None apparent
Foundation Drainage Features	Foundation drain both left and right discharge to impact basin
Toe Drains	Integral with foundation drain
Instrumentation System	None

WEST - AREA INSPECTION REPORT, VEGETATIVE STABILIZATION

MAY 10, 1968 WILLIAM L. WARREN

WEST LAKE: Seeding of the embankment was experimental with strips of various grass and legume species and combinations running at right angles to the center line of the dam. The Crown Vetch strips were excellent. Flat Pea was doing well. Birdsfoot Trefoil was spotty although on one strip it was seeding itself in. Grass strips were poor to terrible and in need of heavy fertilization especially with nitrogen. Topdressing recommendations for 1968 called for 40 lb. N, 80 lb. P_2O_5, 80 lb. K_2O per acre. Was this applied? I recommend that if the trials are complete, the grass areas be reseeded to crown vetch; if not, topdress grass areas with 1000 lb. 5-5-5 with 50% of nitrogen in organic form. Legume areas should be topdressed again this year but 400 lb. of 0-20-20 or equal could be substituted for the 1-2-2 ratio recommended last year.

The entrance channel and control section of the Emergency Spillway was so wet this year that large areas of grass cover drowned out completely. Either the EC will be tile drained or it should be seeded to Reed Canary Grass. With consideration of the soil tests made in Nov. 1967, I recommend working in 25 lb. 12-12-12 or equal and seeding to 1 lb. Reed Canary Grass per 1000 square feet.

Other seeded areas around the dam (spoil deposits, etc.) are in good legume - grass cover and annual topdressing should be continued as last year. The borrow areas and picnic area have low quality grass cover and topdressing as recommended last year should be continued or increased. The two beaches are in poor cover with the day beach kept very wet by seepage from the cut bank (see Technical Team report #68 on West Lake Complex for drainage recommendations and planting recommendations for the bank). Presumably, treatment of the beaches will be covered in the state's development plans and will include sanding.

Protection of the emergency spillway from vehicular encroachment by means of a barrier along the northwest bank is necessary and was also covered in the Technical Team Report. A small gully caused by such traffic should be cleaned out, refilled with earth, limed fertilized and seeded and protected from surface water with a diversion channel above it until healed.

The rock ford on the access road below the dam is in bad condition and as recommended in the Technical Team Report should be replaced with a bridge or properly paved ford.

As recommended in the Technical Team Report, the bank at the east end of the dam should be cleared of overhead shade to permit effective seeding to grass cover.

Carry out all topdressing and seeding operations mentioned above Sept. 15th to Oct.

(cont. on page2)

(Page 2 of 2)

REPORT OF ANNUAL INSPECTION

PL 566 Structures Date: _____

_____ Town _____ Watershed _____

Item	Current Report	
	Remarks and Recommendations	Season
cess Roads .Obstructions		
.Gullying		
.Drainage & Culverts		
purtenances . Plaques		
. Barricades		
. Fences		
. Other		

l Remarks and Recommendations:

Considerable settlement & erosion in disposal area on the D.S. end of the E.S.

(Large seepage on U.S. end of west Berm) Approx 1 acre

Col. Hand
Carl Carlin. Mass Div. Forest & Parks
Henry Mathew Assist Sup: Mass Div. Forest & Parks
Stanley Linkovitch Selectman

it soils tests should be made to determine the amounts of lime and lizer needed. If soils tests are not made, the recommendations below e used.

gatative Check List			Inspection Team			
	Season	Rate				
ng		In.				
g						
ng		T/Ac				
lizing	( )	Lb/Ac				
ng	( ) Species	Lb/Ac				

U-12
Prelim File

REPORT OF ANNUAL INSPECTION
PL 566 Structures

Date

State Alley Town Watershed

ITEM	Current Report	
	Remarks and Recommendations	Reason
A. Embankment		
Slopes		
1. Vegetations		
2. Erosion		
Top of Dam & Berms		
3. Vegetations		
4. Erosion		
Gutters		
5. Vegetations		
6. Erosion		
B. Permanent Pool		
7. Undesirable Vegetation		
8. Debris		
C. Principal Spillway Riser	Need 1 Hole trash	
9. Undermining of Footing		
10. Trash Rack		
11. Gate		
12. Appurtenances		
Conduit		
13. Alignment		
14. Separation of Joints		
15. Cracks		
16. Obstructions		
Dissipation Basin		
17. Trash		
18. Cracks		
19. Drains		
D. Channels & Ditches		
20. Vegetative Cover	Some erosion on Rt side of outlet channel	
21. Erosion		
22. Sedimentation or Riprap		
23. Drains		
E. Emergency Spillway		
24. Vegetations	Considerable slump for eg spoil area on Rt side	
25. Erosion	Rt side cutting ditch bank breaking 5 ft down	
26. Drainage	Left side is wet water & some erosion	
27. Obstructions		

(See over)

The construction of the new access road has created some ponding between the emergency spillway and the rock ford. Areas of this road are quite wet. It is suggested that ditching and/or culverts be considered for this area.

All areas of this site previously seeded need to be limed and fertilized.

Soil tests were made last fall and recommendations for liming and fertilizing submitted by the Department of Plant and Soil Science, University of Massachusetts. On the day of the inspection, it was suggested to the local sponsors that those responsible for O-M take immediate action to lime and fertilize all areas. Application of the materials should be completed by the end of May.

Abbey site

This site was completed in the Fall of 1967. In general, it appears to be in very good condition. There is a small amount of trash at the riser which will be removed. There is some rill erosion on the left side of the outlet channel above the rip-rap. This does not appear serious, but should be checked periodically and reseeding performed when needed.

The emergency spillway presents most of the problems on this site. The disposal area off the left side of the downstream end of the emergency spillway has considerable erosion and settlement. While this is unsightly, it does not create any danger to the structure or effect the operation of the emergency spillway. It is doubtful that drainage could be installed in the disposal area due to presence of rocks and stumps. One solution would be to fill in the eroded and settled areas and reseed. No action is required now.

There is some slumping of the disposal area on the right side of the downstream end of the emergency spillway. At present this is not serious, but it should be checked in July and appropriate action taken.

The left side of the emergency spillway approach channel is wet. This is not a serious condition, but should be checked in July and appropriate action taken.

Water has started a rill on the right side of the emergency spillway discharge channel and is washing over the disposal area.

Reseeding of eroded areas in the emergency spillway discharge channel and the water spreading area to the right of the discharge channel is recommended. A re-evaluation of this problem should be made in July and appropriate action taken.

TO: WATERSHED UNIT FILE

U-12
Prelim File

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
29 Cottage Street
Amherst, Massachusetts 01002

May 22, 1968

On May 1, 1968, the following people met at the Clam River Watershed, West Lake site, for the purpose of conducting an annual inspection on the Abbey and West Lake sites.

Thomas Doucette, Water Resources Commission
Henry Mathew, Assistant Superintendent, Mass. Div. of Forests and Parks
Carl Curtin, Mass. Div. of Forests and Parks
Stanley Linkovitch, Selectman, Sandisfield, Mass.
Colonel K. S. Hand, of Sandisfield
J. Czak, University of Massachusetts
W. Meyer, Chairman, Berkshire (County) Conservation District
W. Heaphy, Berkshire County Engineer
E. Turner, Berkshire County Engineer Office
G. Laycoc, Berkshire County Engineer Office
G. Garaini, Berkshire County Engineer Office
W. Warren, Soil Conservation Service, Pittsfield
C. Moustakis, Soil Conservation Service, Amherst
C. Dodge, Soil Conservation Service, Amherst

West Lake site

This site was completed in the Fall of 1967 and was modified in the Fall of 1968.

Trash has plugged the low stage opening of the riser. The pool will be lowered and trash removed in one week. It appears that ice has broken all the steps out of the riser. Since steps have been deleted from later sites, no recommendation was made on this item.

The gutter on the left abutment is carrying surface water. The tile line installed under the modification has partially drained the wet area on the left abutment. Water is flowing from the left abutment drain pipe. The gutter on the right side shows a few holes due to settlement in the disposal area. No action required at this time.

There are still wet areas in portions of the emergency spillway (primarily the inlet portion). These have been noted previously and are not considered serious. Some erosion was noted in the area of the old access road. This area was seeded in the Fall of 1967. These areas should be checked periodically and corrective measures taken if conditions become critical.

Date	Inspecting Agency
4/26/76	See Listing on Report
4/26/77	"
7/29/77	"
10/11/78	"

3. "As Built" Drawings

Page No.	Description
B-1	Cover Sheet
B-2	Plan of Storage Area
B-3	Plan of Dam Site
B-4	Profiles
B-5	Drainage Details
B-6	Plan-Profile of Principal Spillway
B-7	Riser Details
B-8	Cradle, Collar, Pond Drain and Steel Schedule
B-9	Impact Basin Details
B-10	Logs of Test Holes
B-11	Logs of Test Holes
B-12	Logs of Test Holes
B-13	Logs of Test Holes
B-14	Profile of Principal Spillway
B-15	Collar Steel Schedule
B-16	Rock Surface Treatment
B-17	Berm Revision
B-18	Alterations to Concrete Riser

APPENDIX B

ENGINEERING DATA
INDEX

1. Design and Construction Records:

The following records are kept on file by the U.S. Department of Agriculture, Soil Conservation Service and may be obtained through their office located on Cottage Street in Amherst, Massachusetts.

Design records include the following:

- Construction drawings
- Construction specifications
- Construction revisions
- Design criteria
- Layout
- Hydraulic design
- Foundation and embankment design
- Geology report
- Soil testing report
- Structural computations
- Quantity estimates
- Inspector's notes
- Seeding schedule

Construction records include the following:

- Inspector's and engineer's diaries
- Soil testing reports
- Material certifications
- Equipment guarantees
- Correspondence
- Quantities
- Pay estimates
- "As built" drawings

2. Inspection Reports

Date	Inspecting Agency
5/22/68	See Listing On Report
5/19/69	"
6/11/70	"
9/17/70	"
5/21/71	"
7/25/72	"
6/25/73	"
7/17/74	"

APPENDIX B

ENGINEERING DATA

INSPECTION CHECK LIST

PROJECT Abbey Lake Dam DATE 11/1/79

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	N/A
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	N/A
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

INSPECTION CHECK LIST

PROJECT Abbey Lake Dam DATE 11/1/79

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	Emergency Spillway
a. Approach Channel	
General Condition	Heavy grass & legume growth
Loose Rock Overhanging Channel	None - earth excavation
Trees Overhanging Channel	None
Floor of Approach Channel	Heavy sod cover
b. Weir and Training Walls	N/A
General Condition of Concrete	
Rust or Staining	
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None - earth excavation
Trees Overhanging Channel	None
Floor of Channel	Heavy sod cover - wet on east side
Other Obstructions	None
	Measured width = 48 ft. Control Section 3.0 ft. above W.L. Additional erosion protection needed on right side training embankment and at discharge end of channel at top of slope

INSPECTION CHECK LIST

PROJECT Abbey Lake Dam DATE 11/1/79

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Good
Rust or Staining	None
Spalling	None
Erosion or Cavitation	None Visible
Visible Reinforcing	None
Any Seepage or Efflorescence	None
Condition at Joints	Good
Drain holes	2 Toe drain outlets, no weep holes
Channel	
Loose Rock or Trees Overhanging Channel	None
Condition of Discharge Channel	Good
	Channel is unobstructed with very little vegetation encroachment

INSPECTION CHECK LIST

PROJECT Abbey Lake Dam DATE 11/1/79

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	Good
Rust or Staining on Concrete	None
Spalling	None
Erosion or Cavitation	None Visible
Cracking	None
Alignment of Monoliths	Good
Alignment of Joints	Good alignment - dry joints
Numbering of Monoliths	N/A
	Outlet conduit is 36" diameter with 4 pipe joints visible from outlet end. All joints visibly dry above flow line.
	Water depth @ outlet = 4¼"

INSPECTION CHECK LIST

PROJECT Abbey Lake Dam DATE 11/1/79

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	Note: The access manhole steps have been cutoff flush with the concrete
General Condition	Good
Condition of Joints	Good
Spalling	None
Visible Reinforcing	None
Rusting or Staining of Concrete	Only from trash rack anchor bolts
Any Seepage or Efflorescence	None
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	None visible from top of riser structue
Cracks	None visible
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	No Electrical
~~Air Vents~~	Pond drain sluice gate:
~~Float Wells~~	1. Rodney Hunt 52796-2 S-2600A
~~Crane Hoist~~	2. Condition is good
~~Elevator~~	Note: There are no other mechanical or electrical features
~~Hydraulic System~~	
Service Gates	
~~Emergency Gates~~	
~~Lightning Protection System~~	
~~Emergency Power System~~	
~~Wiring and Lighting System in Gate Chamber~~	

INSPECTION CHECK LIST

PROJECT Abbey Lake Dam DATE 11/1/79

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	N/A
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	N/A
Condition of Concrete	
Stop Logs and Slots	

CROWN LAKE: In general all problems noted in last years' report still remain. There is silting of the entrance channel, the exit channel of the Emergency Spillway, the south slope of the disposal area, and the bank at the end of the Emergency Spillway exit. These should be cleared of stone as needed, repacked with loam and seeded down with appropriate seed and fertilizer.

Grass cover is not taking hold on the left bank above the pipe exit channel. Parts of the cut bank of the borrow area are also almost bare. These should be fertilized and reseeded unless planted solid to shrubs as recommended in the Technical Team Report.

The spoil disposal area is a critical sediment producing area. Future construction should avoid placement of spoil in such a way as to block a natural drainageway. Correction of the condition here will involve a rather expensive culvert with headwalls; or possibly concrete cut-off and retaining walls at each end of the fill area to prevent undermining, followed by repacking the holes and seeding to Reed Canary Grass. Otherwise the soil will continue to be washed out until nothing is left but the rocks and the erosion will eat back up the slope of the disposal area.

Crown Vetch on the dike is vigorous but has not begun to spread out and take over the site. Vegetated areas over all are very variable with good growth here, poor growth there. Topdressing with 400 lb. per acre of 10-20-20 or equal is advised with crews instructed to double this on the obviously poor areas.

Topdressing and seeding operations mentioned above should be carried out about Sept. 15th to 20th.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
29 Cottage Street
Amherst, Massachusetts 01002

REPORT OF THE ANNUAL INSPECTION

CLAM RIVER WATERSHED

June 11, 1970

On May 15, 1970 the following met at the West Lake Site, Clam River Watershed in the town of Sandisfield, Massachusetts for the purpose of conducting the annual inspection of the West Lake Site, the Abbey Site and the South Silver Site:

Thomas Doucette, Water Resources Commission
Fletcher Pyle, Water Resources Commission
Richard Spofford, Water Resources Commission
William Heaphy, County Engineer
Robert Saulnier, Assistant County Engineer
Colonel Hand, Sandisfield, Massachusetts
Stetson Adams, Department of Natural Resources
Edward Konieczny, Soil Conservation Service
James Elasmar, Soil Conservation Service

WEST LAKE SITE

The general appearance of the vegetative cover looks good. There is still a small area on top of the dam that needs to be fertilized with 15-10-10 at the rate of 400 lbs. per acre. 15-10-10 or 10-10-10 or equivalent of either fertilizer is acceptable. Area on the downstream side of the east abutment of the dam is covered with cut grass that has matted down and is smothering new growth of grass. It is recommended that a rotary mower be used for future mowing and area be raked after mowing.

On May 21,1970 Professor John M. Zak applied fertilizer to test plots on this site. Application was the equivalent of 100 lbs. of nitrogen per acre using 15-10-10 on the grass plots. The plots that had legumes received an application of 500 lbs. per acre of 0-20-20. Subsequent examination has shown a remarkable difference in color and growth between areas topdressed and not topdressed.

It was noted that debris and branches were stuck in the riser. This should be cleaned out as soon as possible so as not to plug the outlet. Tree stump at riser should be removed and the outlet channel cleaned. Trash bar missing on south corner of low stage rack and should be replaced. The condition of the concrete is good and the rip-rap at the outlet channel looks very good.

In the permanent pool area downed dead trees at the east end of the dam should be removed. Tom Doucette, WRC, talked to Stetson Adams about the possibility of the State letting a contract to accomplish this work.

Seep at the east abutment was in the same condition as last year. It is recommended that a small ditch be dug to connect this to the upstream and downstream gutters of the dam. Beach area is in the same condition as last year. No facilities yet.

The Department of Natural Resources is responsible for the operation and maintenance of this site.

ABBEY LAKE SITE

The upstream slope of the dam should be fertilized with 10-10-10 at the rate of 400 lbs. per acre on the predominantly grass areas. Where the legumes prevail fertilize with 400 lbs. of 0-20-20 or the equivalent per acre. The downstream slope of the dam looks very good. The slopes of the emergency spillway look much better than a year ago. It is recommended that area be fertilized again this year with 10-10-10 at the rate of 400 lbs. per acre on the predominantly grass areas and the slope area at the southeast end of the emergency spillway be overseeded (100' x 200'). Where the legumes prevail fertilize with 400 lbs. of 0-20-20 or the equivalent per acre. There is a sparse grass stand. In many places cut grass has matted down thus smothering new growth. It is suggested that future mowing be done with a rotary mower and raked.

Sticks and debris around riser should be removed.

The eroded areas on the left abutment and in the disposal area to the left of the emergency spillway are in the same condition as last year. This condition should not get much worse, but there is a possibility that a large storm might wash more material into the stream. However, corrective action in this area might divert the water to another location and possibly cause more damage. It was the general opinion to do nothing now, but to keep a close watch over the area.

A large wood chuck hole on the slope between the emergency spillway and the outlet channel was noted. This hole should be filled as soon as possible to prevent damage to this slope. Channel riprapping and the concrete looked very good. The access road was in good condition. It still needs the addition of some smaller rock to fill the voids.

The Massachusetts Department of Natural Resources is responsible for the operation and maintenance of this site.

SOUTH SILVER SITE

Except where trees and embankments protected last fall's seeding there is little or no grass cover on the South Silver site.

The Commonwealth of Massachusetts
Water Resources Commission
Leverett Saltonstall Building, Government Center
100 Cambridge Street, Boston 02202

OFFICE OF THE DIRECTOR
DIVISION OF WATER RESOURCES

September 17, 1970

Karl R. Klingelhofer
State Conservation Engineer
Soil Conservation Service
29 Cottage Street
Amherst, Mass. 01002

Re: Watershed Maintenance

Dear Karl:

Enclosed please find a completed copy of your Summary of Maintenance Needs.

In the Quaboag Watershed all seeding had to be deleted from the maintenance contract due to budgetary limitations.

Work done on the Clam Watershed was unsatisfactory and the contractor has been ordered to complete the maintenance there. So far all the work that has been done to our satisfaction are the filling of animal holes at the Abbey Site and the removal of dead trees beside the permanent pool at the West Lake Site. All three sites were supposedly limed and fertilized under the supervision of the Division of Forests and Parks.

As yet we know of no effective way to eliminate motor cycle and horse traffic on the sites. Four wheel vehicles for the most part have been kept off the sites.

Some of the work on the Horse Pond site such as removal of brush and dead trees can be done in the future by the clearing contractor. This was taken into consideration when the maintenance contract was written.

The contract for maintenance on the SuAsCo and Quaboag Watersheds was awarded to Caprera Construction Co. of Boylston, Massachusetts with bids of $9,722.50 and $5,600.00 respectively. The maintenance contract for the Clam Watershed was awarded to Arello, Inc. with a low bid of $4,250.00

Very truly yours,

Thomas F. Doucette
Principal Civil Engineer

SEP 2 1970

SUMMARY OF MAINTENANCE NEEDS AND ACCOMPLISHMENTS IN CLAM WATERSHED - 1970
ON PL-566 COMPLETED STRUCTURES IN MASSACHUSETTS

WATERSHED	STRUCTURE	NEED	ACCOMPLISHMENT (Date and Remarks)	APPROXIMATE COST
CLAM	West Lake	1. Mow and rake. 2. Fertilize small area on top of dam with 15-10-10 at 400 lb/acre. 3. Remove debris, branches, and tree stump around riser. 4. Clean outlet channel. 5. Replace trash bar on south corner of low stage trash rack. 6. Downed dead trees at the east end of the dam should be removed. 7. Dig a small ditch to connect seep at east abutment to upstream and downstream gutters of dam.	See attached letter for accomplishments in Clam River Watershed.	$2610.00
	Abbey Lake	1. Upstream slope of dam should be fertilized with 10-10-10 at 400 lb/acre on predominantly grass areas where legumes prevail fertilized with 400 lbs of 0-20-20 or equivalent per acre. 2. Fertilize slopes of emergency spillway with 10-10-10 at 400 lb/acre on predominantly grass areas. Slope area at southeast end of emergency spillway should be over-seeded. Where legumes prevail fertilize with 400 lbs. of 0-20-20 or equivalent per acre.		$690.00

SEP 2 1970

SUMMARY OF MAINTENANCE NEEDS AND ACCOMPLISHMENTS IN CLAM WATERSHED - 1970
ON PL-566 COMPLETED STRUCTURES IN MASSACHUSETTS

WATERSHED	STRUCTURE	NEED	ACCOMPLISHMENT (Date and Remarks)	APPROXIMATE COST
CLAM (cont'd)	Abbey Lake	3. Mow and rake. 4. Sticks and debris around riser should be removed. 5. Fill woodchuck hole on slope between emergency spillway and outlet channel.		
	South Silver	1. Reseed as necessary with same amount and mixtures of seed as originally, but at 10-20 lbs/acre of tall fescue to original mixture. Top dress spotty areas with 10-10-10 or equivalent at 800 lbs/acre. Fertilizer should contain at least 25% of nitrogen in synthetic organic form. 2. Clean riser and trash rack of debris. 3. Check whether pond drain is plugged. 4. Regrade, fertilize and seed erosion on slopes between diversion ditch and emergency spillway.		$950.00

CLAM RIVER
1971

REPORT OF ANNUAL INSPECTION

CLAM RIVER WATERSHED

May 21, 1971

On May 18, 1971 the following met at the West Lake Site, Clam River Watershed in the town of Sandisfield, Massachusetts for the purpose of conducting the annual inspection of the West Lake Site, The abby Site, The South Silver Site and the North Silver Site:

E.T.Lewicke, Water Resources Commission
K. Maguire, Water Resources Commission
Douglas Poland, Natural Resources Commission
Stetson Adams, Department of Natural Resources
Douglas Lyman, Department of Natural Resources
Karl Klingelhofer, Soil Conservation Service
Don Basinger, Soil Conservation Service
Gene Mills, Soil Conservation Service
John Folan, Soil Conservation Service
James Elasmar, Soil Conservation Service
Edward Konieczny, Soil Conservation Service

WEST LAKE SITE

The general appearance of the vegetative cover looks very good. A big improvement from last year. Recommend fertilizing dam area with 5-10-10 at the rate of 600 lbs per acre. Some matting on the downstream slope of dam should be raked.

It was noted that branches and other debris were stuck in the Riser. This should be cleaned out so as not to plug the outlet. Alders growing on both banks of the dam and through the riprap. These alders should be cut and / or sprayed to kill further growth. The condition of the concrete is good and the riprap at the outlet channel looks good.

In the permanent pool area dead trees at the east end of the dam should be removed.

Seep at the east abutment was in the same condition as last year. It is recommended that a ditch be dug to divert the water into the upstream gutter of the dam. The Beach area is in the same condition as last year. No facilities yet.

An animal hole was noted on the downstream slope of the dam. This hole should be filled as soon as possible to prevent damage to the slope.

Repair rock ford in outlet channel so that automobiles may pass over.

The Massachusetts Department of Natural Resources is responsible for the operation and maintenance of this site.

ABBEY LAKE SITE

The vegetative cover was much improved from last year. The downstream slope was exceptionally good. The upstream slope should be fertilized with 5-10-10 at the rate of 600 lbs per acre. Grass in E.S. should be mowed. The slopes at the emergency spillway have improved since last year. It is recommended that the area be fertilized with 5-10-10 at the rate of 600 lbs per acre. It is recommended that tile drain be placed in wet area of Emergency Spillway.

Sticks and other debris around the riser should be removed.

The eroded areas on the left abutment and in the disposal area to the left of the emergency spillway are in the same condition as last year. It was the general opinion to keep a close watch over the area. Channel riprapping and the concrete looked very good.

The Massachusetts Department of Natural Resources is responsible for the operation and maintenance of this site.

SOUTH SILVER SITE

The general appearance of the vegetative cover was very much better than last year. Grass is growing in all areas. It is recommended that entire area be fertilized with 5-10-10 at the rate of 600 lbs per acre.

Several altermatives are present to vegetate the outlet of the emergency spillway at the South Silver Site. One of these is to plant shrubs:

The following shrubs are adaptable: Autumn Olive,Elaeagnus umbellata; spaced 4'x4' or Cornus Stolonifera, Red-Osier Dogwood; spaced 3' x 3' or; Juniperus, Communis, Common Juniper; spaced 5' x 5'.

Because the area is small (about 30' x 40') a solid planting of only one of the above species is recommended.

To help the shrubs grow a small amount of 10-10-10 should be mixed into the soil at planting time (1 oz.) or (1 tablespoon) per seedling, 2 year old.

Mulch after planting, wood chips to depth of 2 inches or old hay 2-4 inches.

The other altermative is to fill the rills created by water with a

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
29 Cottage Street
Amherst, Massachusetts 01002

July 25, 1972

REPORT OF ANNUAL INSPECTION

Clam River Watershed

On May 16, 1972, the following met at the South Silver Site, Clam River Watershed, in the Town of Sandisfield, Massachusetts, for the purpose of conducting the annual inspection of the South Silver Site, the North Silver Site, West Lake Site and the Abbey Site.

E. T. Lewicke, Water Resources Commission, Boston, Mass.
Col. K. S. Hand, Sandisfield, Mass.
Stetson Adams, Department of Natural Resources
Douglas Lyman, Department of Natural Resources
John F. Folan, Soil Conservation Service
James J. Elasmar, Soil Conservation Service

GENERAL

The Massachusetts Department of Natural Resources is responsible for the operation and maintenance of the sites.

Edward G. Konieczny, District Conservationist, SCS, was not present on May 16, 1972; however, he made a separate inspection trip at a later date and his comments on agronomic conditions and recommendations are included.

SOUTH SILVER SITE

Structural Conditions and Recommendations

Erosion was noted on the slopes between the diversion ditch and the emergency spillway. This condition is the same as it was a year ago. Erosion was also noted in the emergency spillway at the end of the dike. This area is no worse than it was a year ago. The access road and the road ditches need to be graded. Culverts need annual cleaning. Debris should be removed from the trash rack of the riser and from edges of the pool. The concrete in the riser looks good.

Agronomic Conditions and Recommendations

Grass on the earthen dam looks better than it has ever been. Flooding has killed off grasses in a strip 15 to 20 feet wide, the length of the dam. The dead grasses have created an effective mulch.

ABBEY LAKE SITE

Structural Conditions and Recommendations

Branches and other debris around the riser should be removed. The eroded areas on the left abutment and in the disposal area to the left of the emergency spillway are in the same condition as last year. Channel riprapping and the concrete looked very good.

Agronomic Conditions and Recommendations

Very effective mulch has been created by Crownvetch. Patches of Birdsfoot Trefoil are found throughout the area.

At outlet of emergency spillway Birdsfoot Trefoil is about 50% of cover. A light dose of 5-10-10 (400 pounds) or 8-16-16 (300 pounds) would help maintain legumes.

WEST LAKE SITE

Structural Conditions and Recommendations

Branches and other debris should be removed from toe of dam and riser area. The condition of the concrete and the riprap at the outlet channel looks good. In the permanent pool area, dead trees at the east end of the dam should be removed. Seep at the east abutment was in the same condition as last year. The beach area is in the same condition as last year. No facilities yet.

Agronomic Conditions and Recommendations

Thirty to forty willow trees 2 to 5 feet in height have become established at the edge of the riprap on the earth dam. Crownvetch mulch is present over most of the area. Apparently no mowing has taken place during the last two years.

Willow and alder are becoming established in open area between the maintenance shed and the lake. The trees are growing through the mulch and they will eventually present a problem if the area is to remain open. Cattails growing in wet pockets in this open area are esthetically pleasing.

Removal of trees and shrubs on the dam by pulling out or by chemical treatment is recommended.

Topdressing legumes, particularly on the dam at the rate of 400 pounds of 5-10-10 or 300 pounds of 8-16-16 is also recommended.

Submitted by

James Elasmar/nnf
Project Engineer

Edward Konieczny/nnf
District Conservationist

cc: Water Resources Commission (2)
J. Elasmar
E. Konieczny
County Engineer (Heaphy)
C. Moustakis
Chairman, Berkshire Cons. District
A. Verdi (4)
C. E. Mills
W/S File (2)

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
29 Cottage Street
Amherst, Massachusetts 01002

June 25, 1973

REPORT OF ANNUAL INSPECTION

Clam River Watershed

On May 4, 1973, the following met at West Lake Site, Clam River Watershed, in the Town of Sandisfield, Massachusetts, for the purpose of conducting the annual inspection of the West Lake Site, the Abbey Site, the South Silver Site, and the North Silver Site:

Kevin Maguire, Water Resources Commission, Boston, Mass.
Stetson Adams, Department of Natural Resources
Edward G. Konieczny, Soil Conservation Service
James. J. Elasmar, Soil Conservation Service

GENERAL

The Massachusetts Department of Natural Resources is responsible for the operation and maintenance of the sites.

WEST LAKE SITE

Structural Conditions and Recommendations

Branches and other debris should be removed from the toe of the dam and around the riser. In the permanent pool area, remove dead tree and other debris at the east end of the dam. Seep at the east abutment is the same as last year. Beach area is same as last year. The condition of the concrete and the riprap at the outlet channel looks good. No facilities as yet.

Agronomic Conditions and Recommendations

Willows and aspen 3 to 8 feet tall have become established within the rock riprap, primarily on the north side of the dam (West Street side). Some of the trees are now too large to pull out by hand.

Vegetation on the dam looks very good and is providing effective ground cover. The dam has not been mowed. Predominant cover is crownvetch and it does not require mowing.

Area between maintenance shed and West Lake.
Willows and alders are established in the wet areas. Small trees are becoming established in the crownvetch and birdsfoot trefoil plantings.

Access road below the dam.
Tree seedlings are growing in the roadway. A newly erected sign allowing snowmobiling was observed along the road.

Trees and shrubs should be removed from the riprap area by pulling or by cutting and treating the stumps to prevent resprouting. The tree seedlings that are becoming established in the seeded area between the maintenance shed and West Lake should also be pulled out.

Lime at the rate of 2 tons per acre on all legume and grass areas to help to maintain desirable soil pH. Fertilize these areas with 600 pounds, 5-10-10 or 400 pounds, 8-16-16, or equivalent. It is desirable to maintain fertility for the growth of grasses and legumes. At least 25% of the nitrogen should be derived from an organic source.

Improvement of the roadway below the dam is needed for recreation uses and for access to the Abbey Lake Site. A bridge or culvert in the outlet channel is needed to cross the stream. Because the roadway on both sides of the stream is wet, roadside drains and a gravel base are required to develop it for recreation uses and as an access road to the Abbey Lake Site.

ABBEY LAKE SITE

Structural Conditions and Recommendations

Branches and other debris around the riser should be removed. Ditch along the access road needs to be regraded and a large tree should be removed from this road. Culverts need to be cleaned. The concrete and the channel riprap look very good.

Agronomic Conditions and Recommendations

A very effective mulch cover has been created by crownvetch and birdsfoot trefoil. The birdsfoot trefoil appears to be spreading and growing as well as the crownvetch. The mulch created by the birdsfoot trefoil, however, is not as thick.

An application of 2 tons of ground limestone and 600 pounds of 5-10-10 or 400 pounds of 8-16-16 or equivalent, per acre, will help to maintain soil pH and fertility for legumes. Part of the nitrogen, at least 25%, should be derived from an organic source.

NORTH SILVER SITE

Structural Conditions and Recommendations

Remove logs along toe of dam and from trash rack of riser. Sloughed area from Sta 53+50 to Sta 55+00 has stabilized itself. It is recommended to seed sloughed area from Sta 66+00 to Sta 67+25. This area is a little worse than it was a year ago. See recommended seeding rates given below.

Agronomic Conditions and Recommendations

Grasses growing on the water side of the dam are spindly. Several bare spots, also on the water side of the dam, were observed. The White and Alsike clover strips observed last spring are not as prominent as they were last year. There is a pathway on top of the dam.

July 17, 1974

REPORT OF ANNUAL INSPECTION

Clam River Watershed
Massachusetts

On July 16, 1974, the following met at West Lake Site, Clam River Watershed, in the town of Sandisfield, Massachusetts, for the purpose of conducting the annual inspection of the West Lake Site, the Abbey Site, the South Silver Site and the North Silver Site:

Kevin Maguire, Water Resources Commission, Boston, MA
Carl Curtin, Dept. of Natural Resources, Pittsfield, MA (DF&P)
Roger Northrup, Mass. Dept. of Public Works, Lenox, MA
Paul Fezzie, Mass. DPW, Lenox, MA
Cecil B. Currin, Soil Conservation Service, Amherst, MA
James J. Elasmar, Soil Conservation Service, Otis, MA
Ronald E. Thompson, Soil Conservation Service, Pittsfield, Mass.

GENERAL

The Massachusetts Department of Natural Resources is responsible for the operation and maintenance of the sites.

Structural Conditions and Recommendations

WEST LAKE SITE

1. Trees and shrubs should be removed from the emergency spillway.
2. Remove trees and shrubs from slopes of dam and around the outlet channel.
3. Remove logs and debris from around the trash racks.

ABBEY SITE

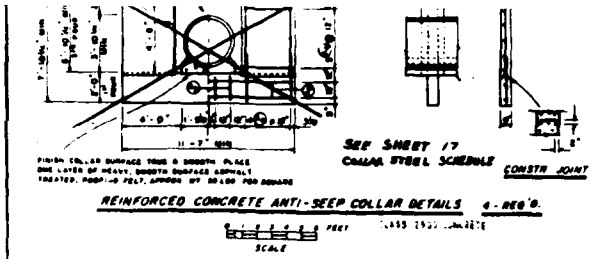
1. Branches and other debris around the riser should be removed.
2. Remove shrubs and trees from the slopes of dam.
3. Mow small area upstream of the dam.
4. The concrete and the channel riprap look good.

NORTH SILVER SITE

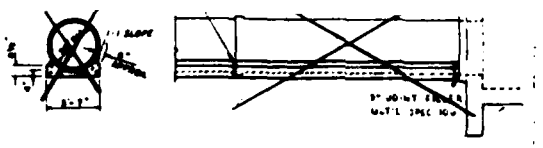
1. Remove logs and other debris from trash racks and from edges of permanent pool.
2. Remove logs from toe of dam.
3. Concrete at the riser and outlet channel look good.

SOUTH SILVER SITE

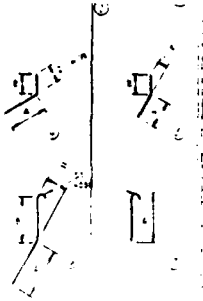
1. Access road and ditches should be regraded.
2. Culverts need to be cleaned.
3. Debris should be removed from trash racks of the riser and from the edges of the pool.
4. Remove boulders from emergency spillway.
5. Concrete in the riser looks good.

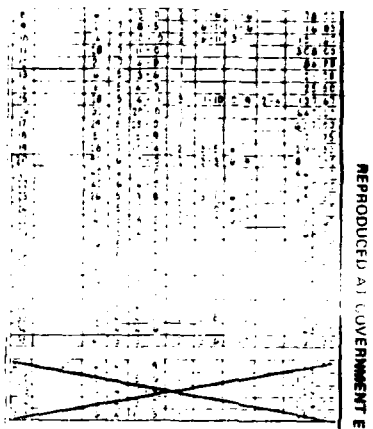


REINFORCED CONCRETE ANTI-SEEP COLLAR DETAILS 4-REG'D.



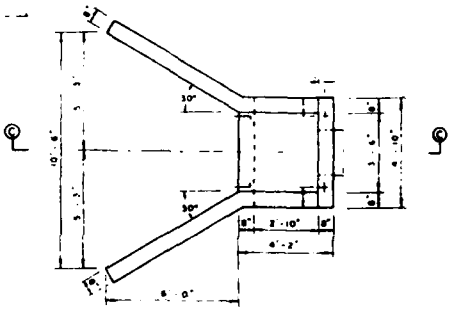
CONCRETE BEDDING DETAILS- SEE SHEET 16





GENERAL NOTES:

1. ALL REINFORCING STEEL PLACED IN CONCRETE POURED AGAINST THE GROUND SHALL HAVE A MINIMUM OF 3" CLEAR COVER. WHERE FORMS ARE USED, REINFORCING STEEL SHALL HAVE A MINIMUM OF 2" CLEAR COVER.
2. ALL EXPOSED EDGES OF CONCRETE TO HAVE A ¾" CHAMFER UNLESS OTHERWISE NOTED.



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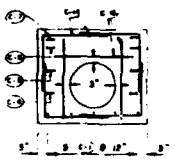
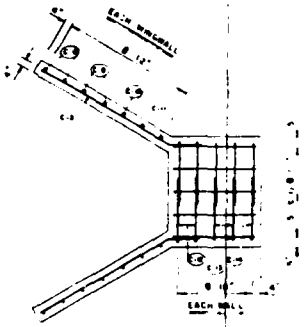


SECTION B-B



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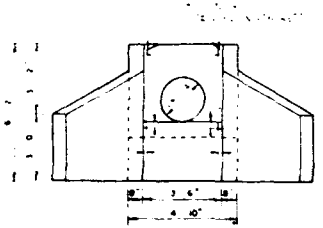
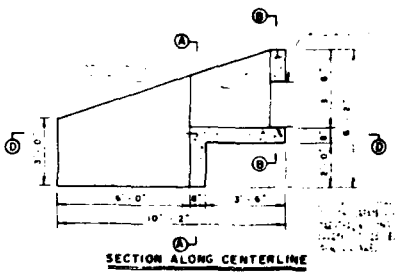


UPSTREAM ELEVATION



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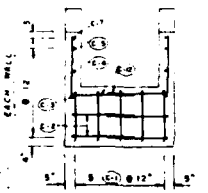

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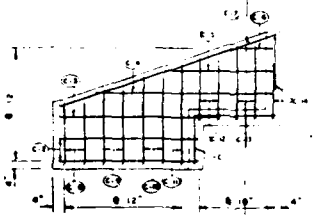


SECTION C-C

POND DRAIN INLET DETAILS

AS BUILT

CLAM RIVER WATERSHED PROJECT
ABBEY LAKE MULTIPLE PURPOSE DAM
SANDISFIELD MASSACHUSETTS

CRADLE, COLLAR, POND DRAIN & STEEL SCHEDULE

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MA-352-P

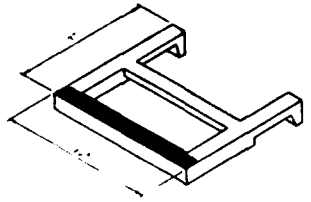
B-8

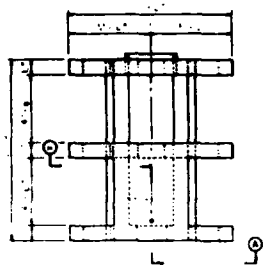
T = WALL THICKNESS

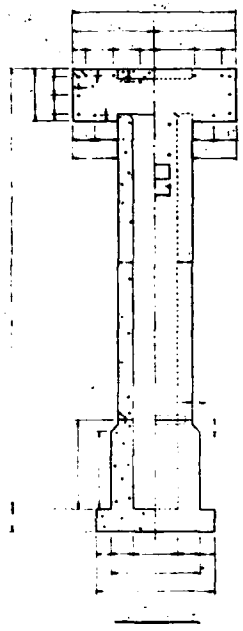
PLATE CONSTR JOINT
FOR ALL RISER JOINTS

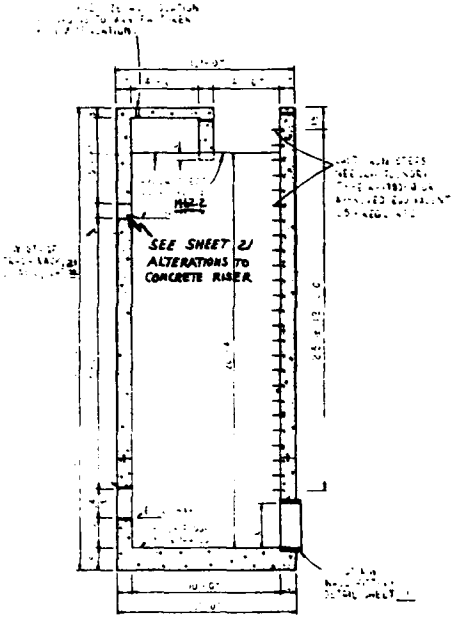
NOTE
FROM ELEV 1400.5 (BOTTOM OF THE RISER SLAB) TO ELEV 1408.0 SHALL BE A MONOLITHIC POUR

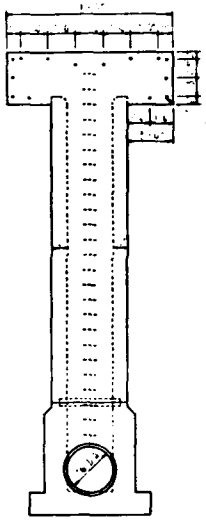
SLUICE GATE NOTE:
1. 24" DIA. SLUICE GATE, ROBINEY HUNT MODEL 1800 SA APPROVED EQUIVALENT.
2. 12" TYPE WALL THIMBLE - 9" DEEP
3. 1 1/2" DIA. ALLOY STEM (THREADED PORTION BALANCED)
4. LIFT TYPE SLUICE GATE
5. UNSEATING HEAD = 26.0 FT.
6. OPERATING HEAD = 26.0 FT.
7. BALANCED LIFT NUT AND SEAT FACINGS
8. STEM GUIDES TO BE SPACED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

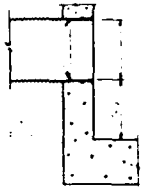












AS BUILT

CLAM RIVER WATERSHED PROJECT
ABBEY LAKE MULTIPLE PURPOSE DAM
SANDISFIELD, MASSACHUSETTS
RISER DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MA-352-P

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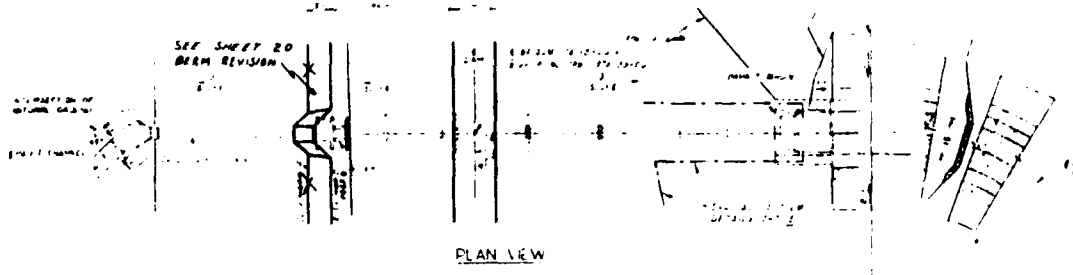
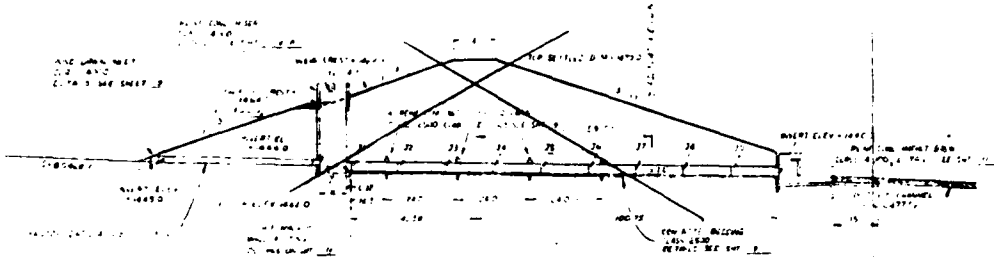


PLAN VIEW

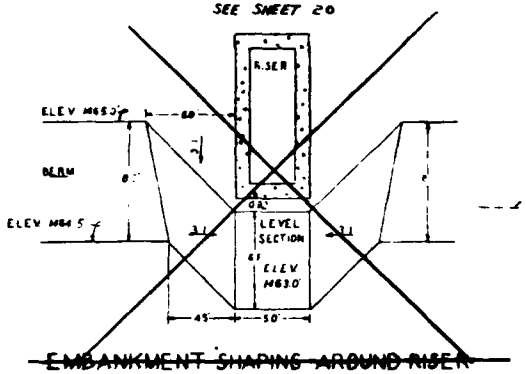


JOINT NUMBER	DISTANCE FROM RISER	INVERT ELEV.
	33	
2	16 33	
3	32 33	
4	48 33	
5	64 33	
6	80 33	
7	96 33	
8	112 33	
9	128 33	
OUTLET	144 33	

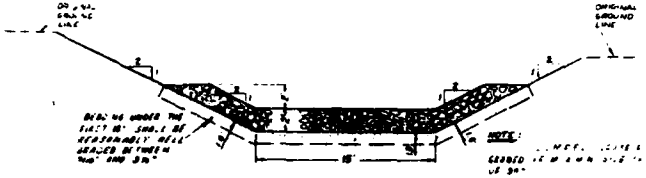
SEE SHEET 16

SEE SHEET 16
PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY

SCALE



EMBANKMENT SHAPING AROUND RISER



SECTION – RIPRAP CHANNEL

AS BUILT

CLAM RIVER WATERSHED PROJ
ABBEY LAKE MUNICIPAL IMPOUNDMENT
SANDWICH, MASSACHUSETTS

PLAN-PROFILE OF PRINCIPAL SPILLWAY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	S.G. CLAUGHTON	12/64
Drawn	R.D. McDOWELL	12/64
Traced	R.M. CLARKE	1/65
Sheet No.	4 of 5 Sheets	
Drawing No.	MA-352 P	

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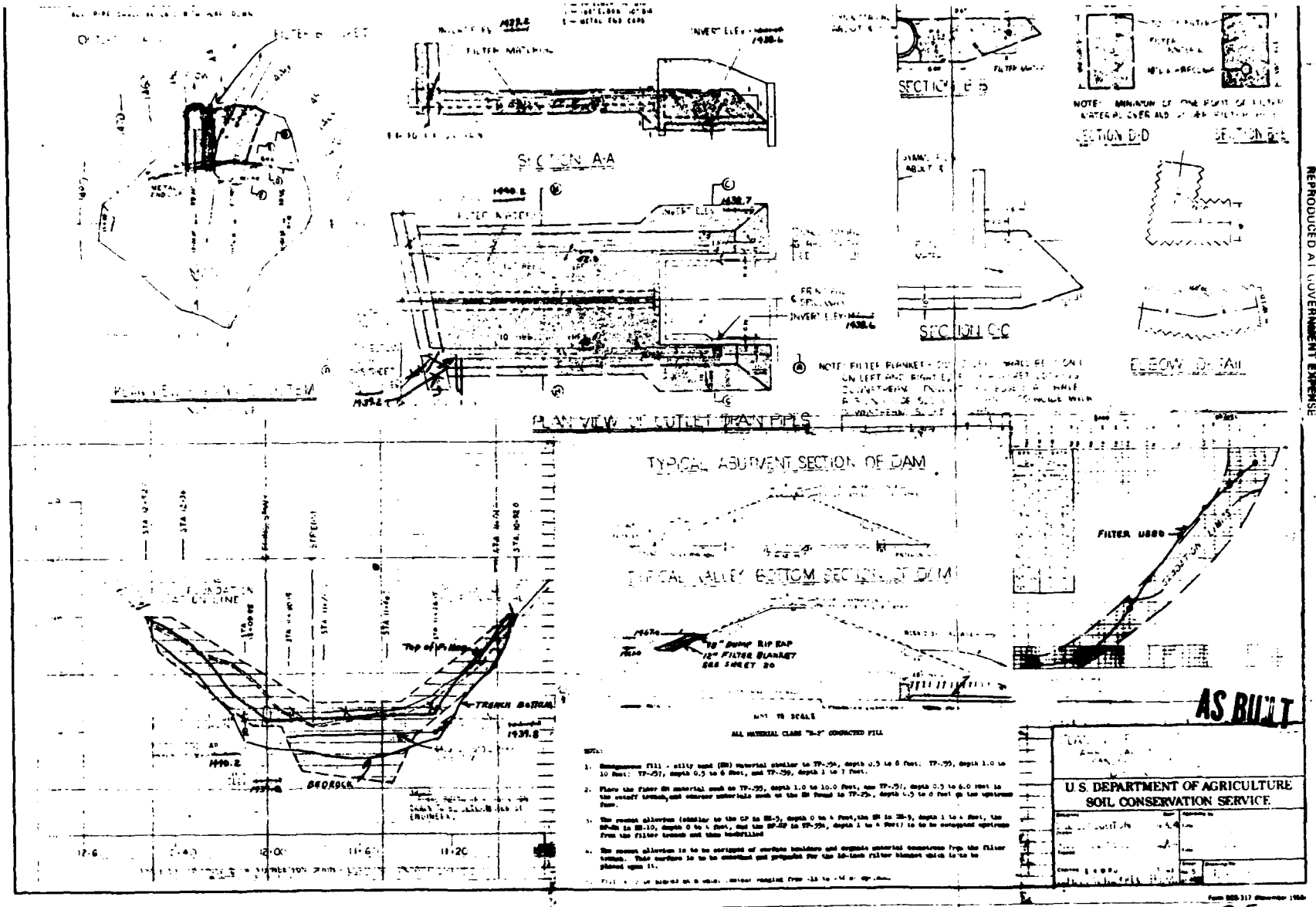

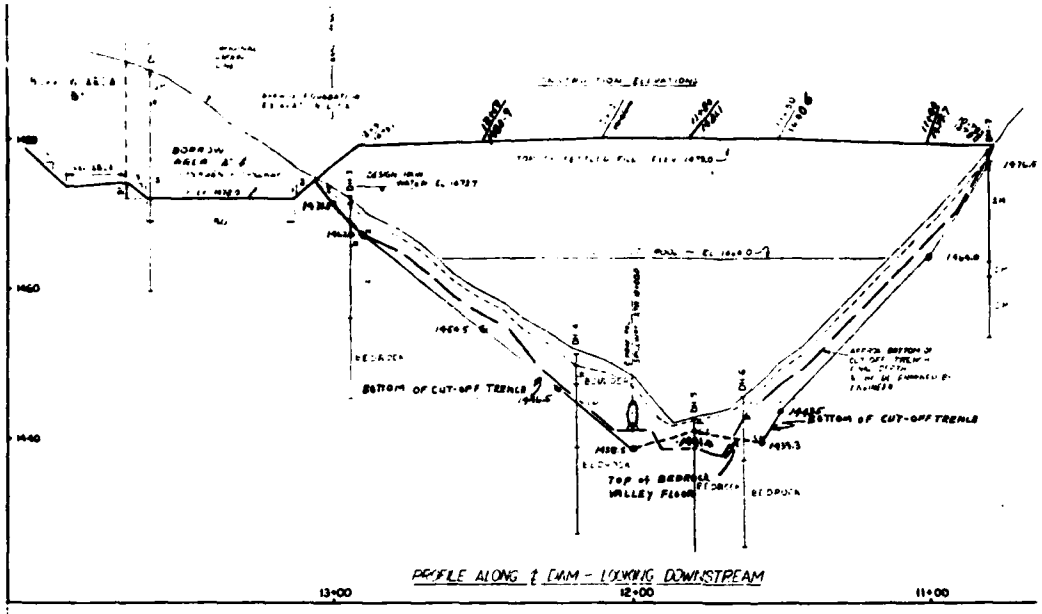

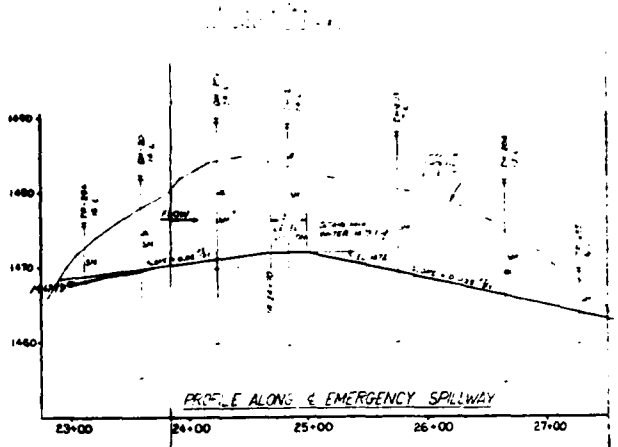

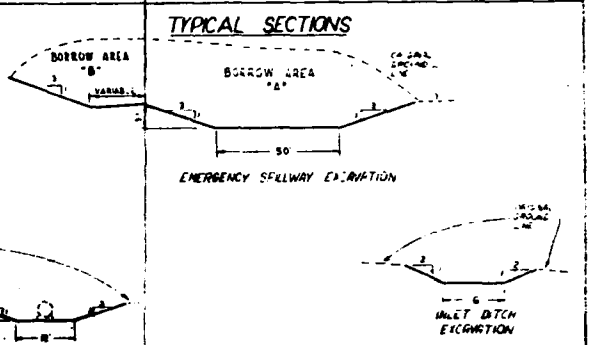

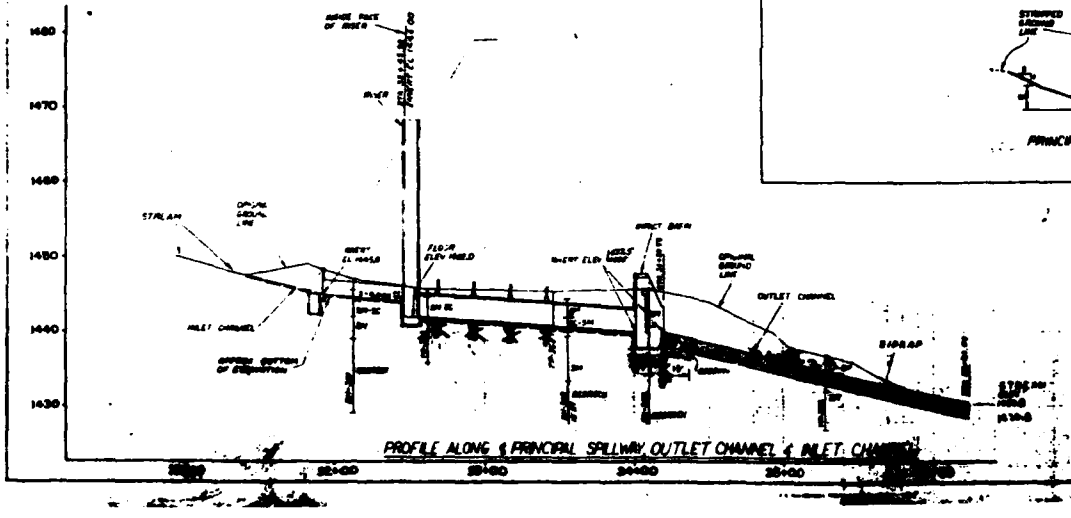

AS BUILT

CLAM RIVER WATERSHED PROJECT
ABBEY LAKE MULTIPLE PURPOSE DAM
SANDISFIELD, MASSACHUSETTS
PROFILES
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

NA-352-P

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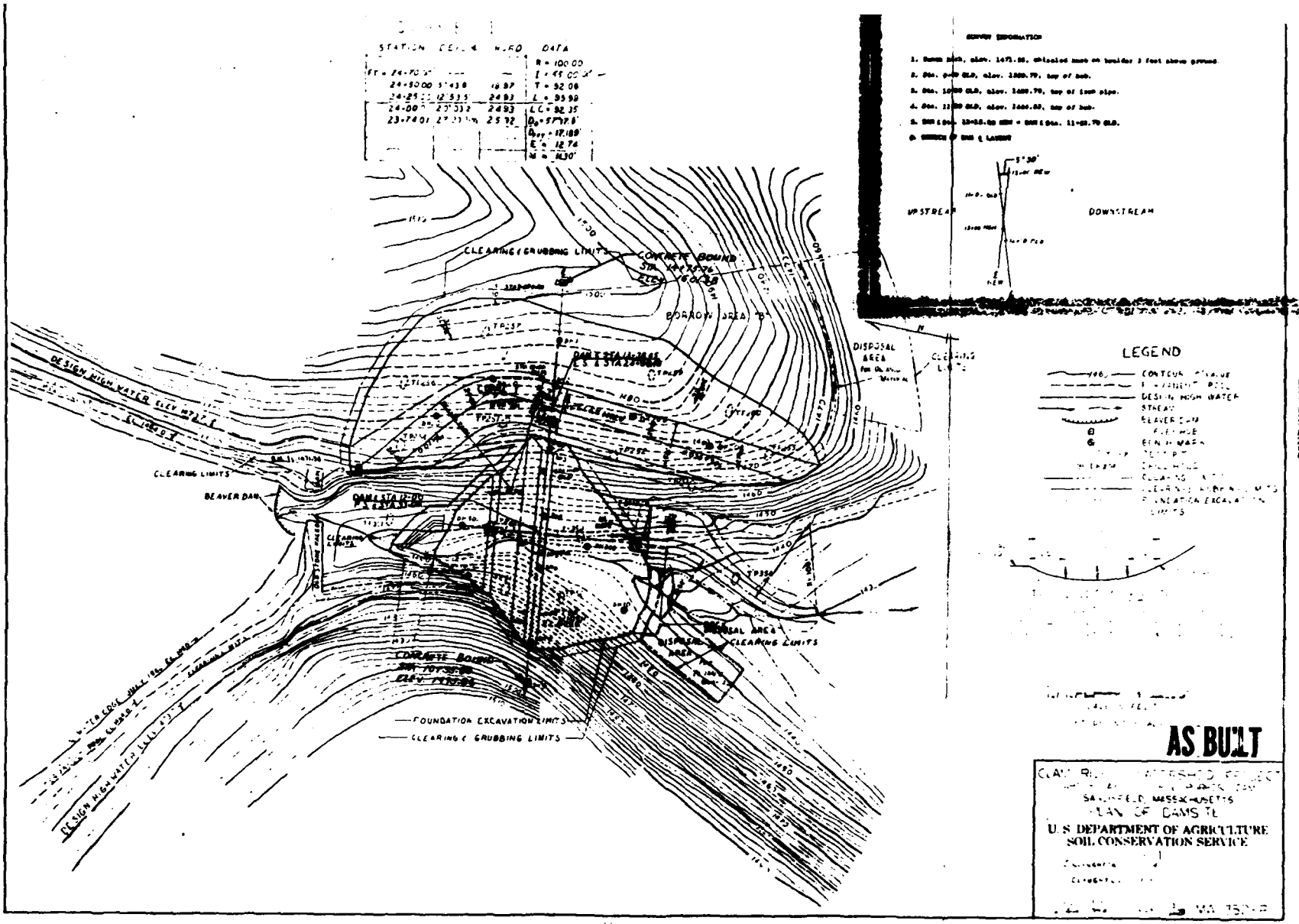

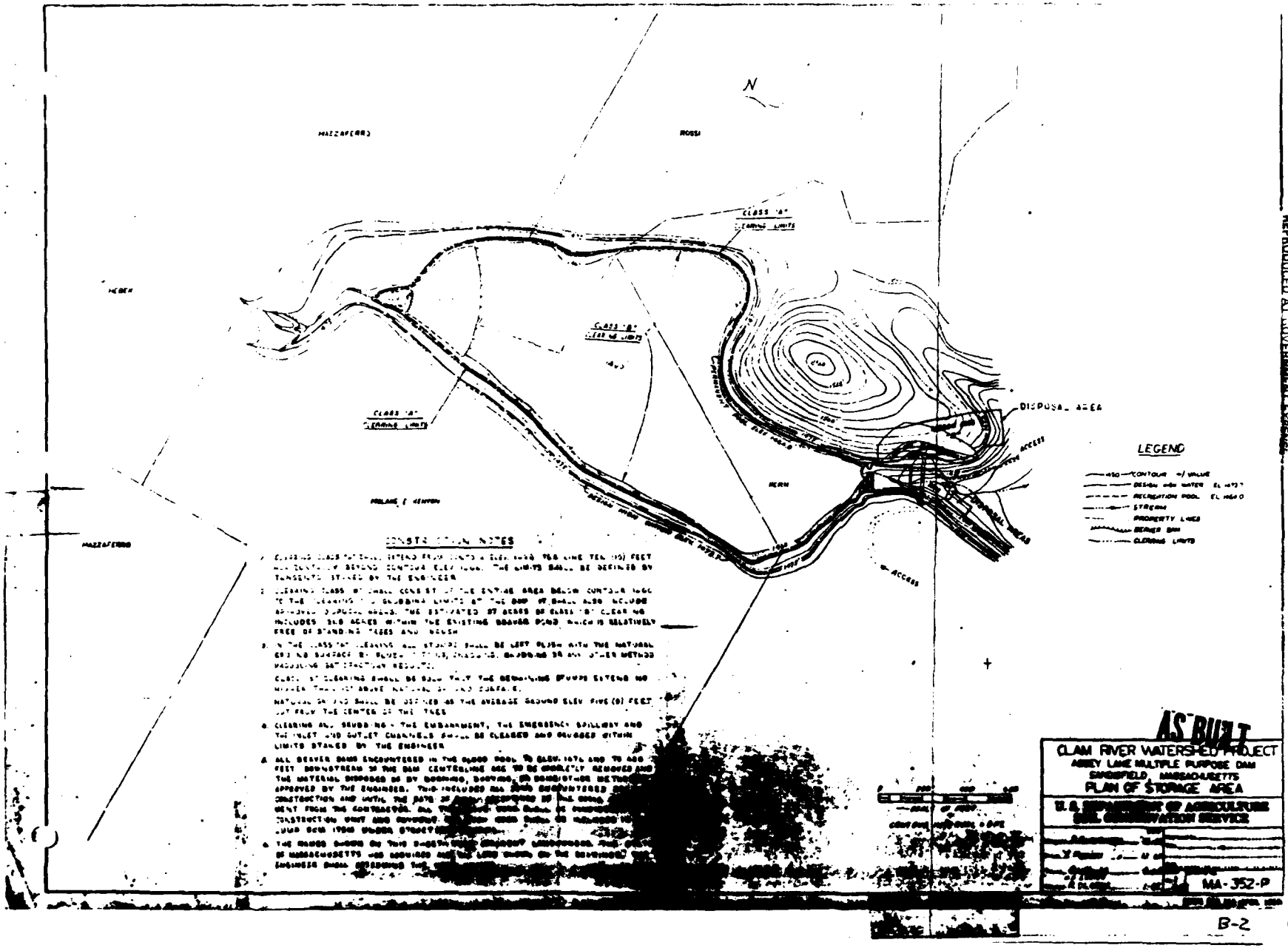

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CLAM RIVER WATERSHED PROJECT

ABBEY LAKE MULTIPLE PURPOSE DAM

RECREATION DEVELOPMENT AND FLOOD PREVENTION

DRAINAGE AREA	1120	ACRES
TOTAL STORAGE	546	ACRE FEET
FLOODWATER RETARDING STORAGE TO EMERGENCY SPILLWAY CREST	327	ACRE FEET
WATER SURFACE AREA AT RECREATION POOL	37	ACRES
HEIGHT OF DAM	37	FEET
VOLUME OF FILL	21,000	CUBIC YARDS

BUILT UNDER THE WATERSHED PROTECTION AND FLOOD PREVENTION ACT

by

MASSACHUSETTS WATER RESOURCES COMMISSION

and

BERKSHIRE CONSERVATION DISTRICT

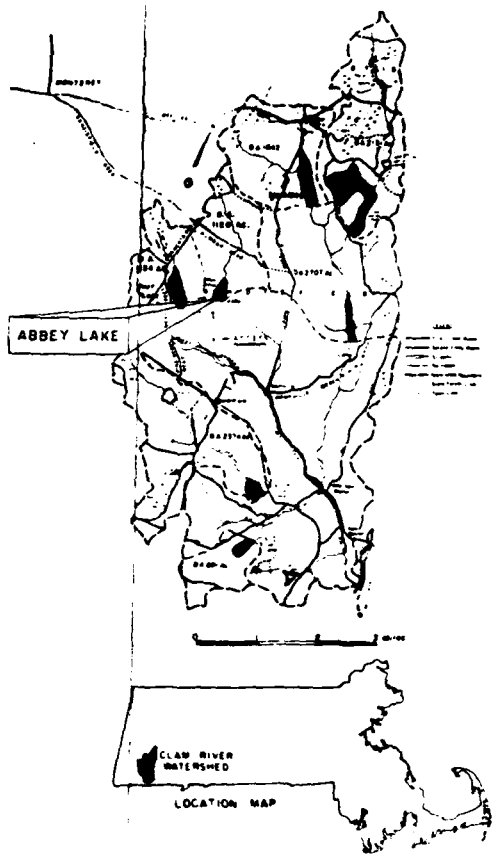
with the assistance of

SOIL CONSERVATION SERVICE

of the

UNITED STATES DEPARTMENT OF AGRICULTURE

1965



INDEX

AS BUILT

Prepared ... 11-65

Checked ... 11-65

Approved by ... U.S.C.S.

AS BUILT

APPROVED ... DATE

BERKSHIRE COUNTY COMMISSIONERS

CLAM RIVER WATERSHED PROJECT

ABBEY LAKE MULTIPLE PURPOSE DAM

SANDISFIELD MASSACHUSETTS

COVER SHEET

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MA-352-P

Design

B-1

USDA, SOIL CONSERVAT. SERVICE
AMHERST, MASSACHUSETTS

MA-AS-10
8-78
File Code 12-

OPERATION AND MAINTENANCE RECORD

Project and Site Abbey LAKE Date Oct 11, 1978

Sponsoring Local Organization Div. of Water Res.

The Operation and Maintenance Inspection Record dated June 14, 1978 showed a need for certain maintenance and repair work. This and other maintenanc been completed as follows:

Agreed to Item No.	Maintenance Performed by: (contributed Labor, Force Account, Contract, Etc.)	Actual Costs	Date Compl
	Spread gravel on Access Road - 30 yds		
	Remove logs and debris from TRASH Rack		
	Cut brush on Slopes of Dam, also Rip-Rap		
	Cut brush & tree growth both sides of channel		
	Cut brush & tree growth in E.S.		
	Mow top of DAM		
	Remove fallen tree across discharge channel side		
		1500.00	8/31/

REMARKS:

Ernest Klunzpeir
SLO Representative

SCS Representative

Distribution:
Mass.DWR;FmHA (if loan involved)
SCS
Sponsor

Report due: Annually

NA-AS-TRIAL
3/22/76

C RATION AND MAINTENANCE INSPECTION RECORD

U.S. Dept. of Agriculture
Soil Conservation Service

Project CLAM RIVER WATERSHED Inspection Date 10-4-78

Site Name/No. ABBEY Type FLOOD RETARDING

Type of Inspection: Special ☐ Annual ☒

Structure Operation: Satisfactory ☒ Unsatisfactory ☐

Sponsoring Local Organization: BERKSHIRE CONSERVATION DISTRICT, W.R.C.

Present for Inspection: Ron Thompson, Russ Curren, Tisbas, James J Clemmer, ERNIE STRZELECKI, THOMAS A DeVOSTE, WRC

ITEM	Condition * S or U	Maintenance & Needed Repairs	Estimated Costs	Agreed Date Repairs to be Complete
1. Vegetation	S	FERTILIZE 10-10-10 400 #/ACRE	950 -	APRIL 1979
2. Fences	S			/
3. Principal Spillway	S	REMOVE DEBRIS INSIDE RISER AND FROM TRASH RACK	350 -	APRIL 1979
4. Emergency Spillway	S			
5. Embankment & Riprap	S	CUT BRUSH D/S AND U/S SLOPES OF DAM	1000 -	APRIL 1979
6. Reservoir Area	S			
7. Gates or Valves				
8. Outlet Channels				
9. Structure Drainage Outlets	S	CLEAN OUT DRAIN PIPE	175 -	
10. Access Rd.				
11.				

REMARKS: (over)

* S = Satisfactory; U = Unsatisfactory

Ronald E Thompson (District Conservationist) James J Clemmer (Project Engineer) Thomas E Devoste (SLO Representative)

(Report due annually: July 1)

MA-AS-TRIAL
3/22/76

U.S. Department of Agriculture
Soil Conservation Service

OPERATION AND MAINTENANCE RECORD

Project Abbey LAKE Date July 29, 1977

Sponsoring Local Organization Water Resources

The Operation and Maintenance Inspection Record dated 4/26/77 showed a need for certain maintenance and repair jobs. These jobs have been completed as follows:

Agreed to Item No.	Maintenance Performed by: (Contributed Labor, Force Account, Contract, Etc.)	Actual Costs	Date Completed
	Remove logs & debris from trash rack		
	Remove brush @ inlet Area		
	Remove logs & brush downstream		
	From toe drain cut brush		
	Emergency Spillway and V slope		
		1100.-	7/29/77

REMARKS:

SCS Representative

Ernest Bruzzese
SLO Representative

Distribution:
Mass.DWR;FmHA (if loan involved)
SCS

Report due: Annually
Nov. 1

MA-AS-TRAL
3/22/76

OPERATION AND MAINTENANCE INSPECTION RECORD

U.S. Dept. of Agriculture
Soil Conservation Service

Project CLAIM RIVER W/S Inspection Date 4/26/77

Site Name/No. ABBEY LAKE Type Flood Retarding

Type of Inspection: Special ☐ Annual ☒ Structure Operation: Satisfactory ☒ Unsatisfactory ☐

Sponsoring Local Organization: Belestine Conservation District, W.R.C.

Present for Inspection: Ernest Stuzzano, W.R.C. Russell Simpson, James Ellenson (SCS)

ITEM	Condition * S or U	Maintenance & Needed Repairs	Estimated Costs	Agreed Date Repairs to be Complete
1. Vegetation	S	Fertilize - 0-20-20 3 Acres	$400.-	7/77
2. Fences	S	Cable repaired	—	
3. Principal Spillway	S	Remove logs + debris from trash rack	$100.-	7/77
4. Emergency Spillway	S	Remove brush inlet area	$100.-	7/77
5. Embankment & Riprap	U	Remove logs and brush D/S Toe. Cut brush Spillway slope	$150.-	7/77
6. Reservoir Area	S		—	
7. Gates or Valves	U	Gate does not fully close, stem bracket missing	$1,500.-	?
8. Outlet Channels	S	Remove logs, side of channel	$100.-	7/77
9. Structure Drainage Outlets	S			
10. Access Rd.	S	Remove fallen trees	$100.-	7/77
11.		Tile	$2,500.-	

REMARKS: (over)

* S = Satisfactory; U = Unsatisfactory

Russell Simpson and James Ellenson (District Conservationist)

(Project Engineer)

Ernest Stuzzano (SLO Representative)

(Report due annually: July 1)

MA-AS-TRIAL
3/22/76

RATION AND MAINTENANCE INSPECTION RECORD

U.S. Dept. of Agriculture
Soil Conservation Service

Project Clam Inspection Date 4/20/76

Site Name/No. Abbey Type Flood Retarding

Type of Inspection: Special ☐ Annual ☒

Structure Operation: Satisfactory ☒ Unsatisfactory ☐

Sponsoring Local Organization: Berkshire Conservation District, Upper Res

Present for Inspection: Chris Penny (SCS), Carl Cartin (SCS), Doug Poland (Dam) Owner. Ernie Struzzieri (WRG), Ron Thompson (SCS) (Reviewed site alone)

ITEM	Condition * S or U	Maintenance & Needed Repairs	Estimated Costs	Agreed Date Repairs to be Complete
1. Vegetation	S	fertilize 0-20-20 2.5 Ac	$300	July
2. Fences	U	Repair Coble & Gate - Access Rd	$30	
3. Principal Spillway	U	Clean logs + Brush out of Trash Racks	$150	21
4. Emergency Spillway	U	Brush in E.S. inlet area + on left slope	$150.	1976
5. Embankment & Riprap	U	Pull all brush. Extend up (Riprap) the U.S. slope of Dam. 6.0'	$2500.00	
6. Reservoir Area	S	P.S. Gate storm Broken. Needs to be replaced.	—	
7. Gates or Valves	U	P.S Gate storm broken. Needs to be replaced.	$1200	?
8. Outlet Channels	U	Riprap in outlet channel & trash removed from channel banks	$500	
9. Structure Drainage Outlets	S		—	
10. Access Rd.	S		—	
11.		total	$6,250	

REMARKS: (over)

* S = Satisfactory; U = Unsatisfactory

Ronald E. Thompson (District Conservationist) Christopher R. Penny acting (Project Engineer) Ernest Struzzieri (SLO Representative)

(Report due, annually: July 1)

Agronomic Conditions and Recommendations

ABBEY SITE

Vegetation on the dam looks very good and is providing very effective cover. Dam top and spillway should be mowed and should be fertilized with 600 pounds of 5-10-10 or equivalent. At least 25% should be derived from an organic source.

WEST LAKE SITE

Willows and aspen 3 to 5 feet tall have become established within the rock riprap, primarily on the north side of the dam. These should be removed along with the dead material along the water line.

Vegetation on the dam is in good shape. Predominant cover is crown-vetch and it does not require mowing. The top of dam and the spillway should be mowed and fertilized with 600 pounds of 5-10-10 or equivalent. At least 25% should be derived from an organic source. The area should also be limed at a rate of two tons/acre to maintain desirable soil ph.

NORTH SILVER SITE

Vegetation is not as good as on the other sites. The site should be limed with two tons/acre and fertilized with 600 pounds of 10-10-10 or equivalent. The top of dam and spillway should be mowed.

The scar from the "slip area" is still visible. The area should be reseeded after lime and fertilizer is spread.

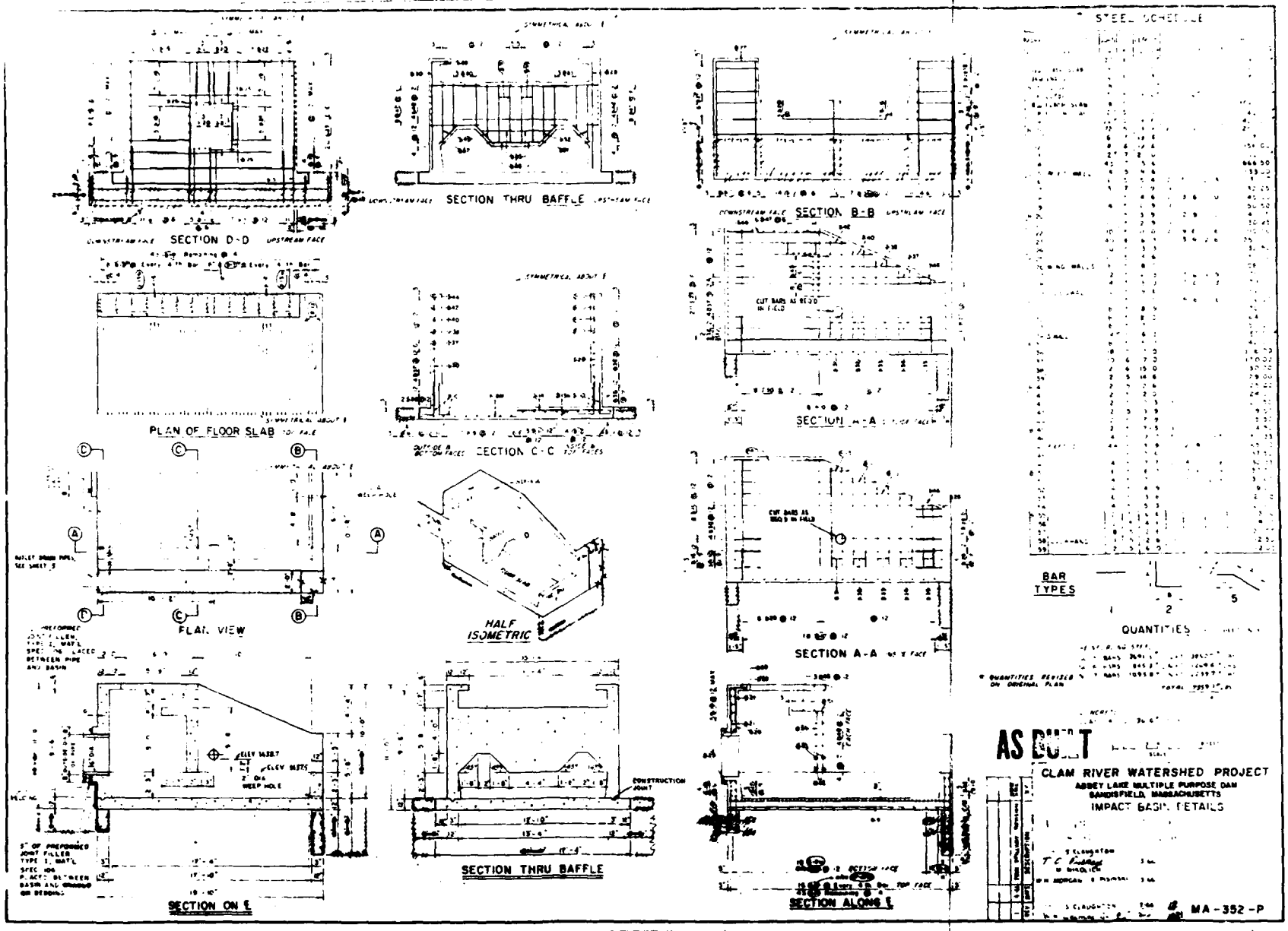
SOUTH SILVER SITE

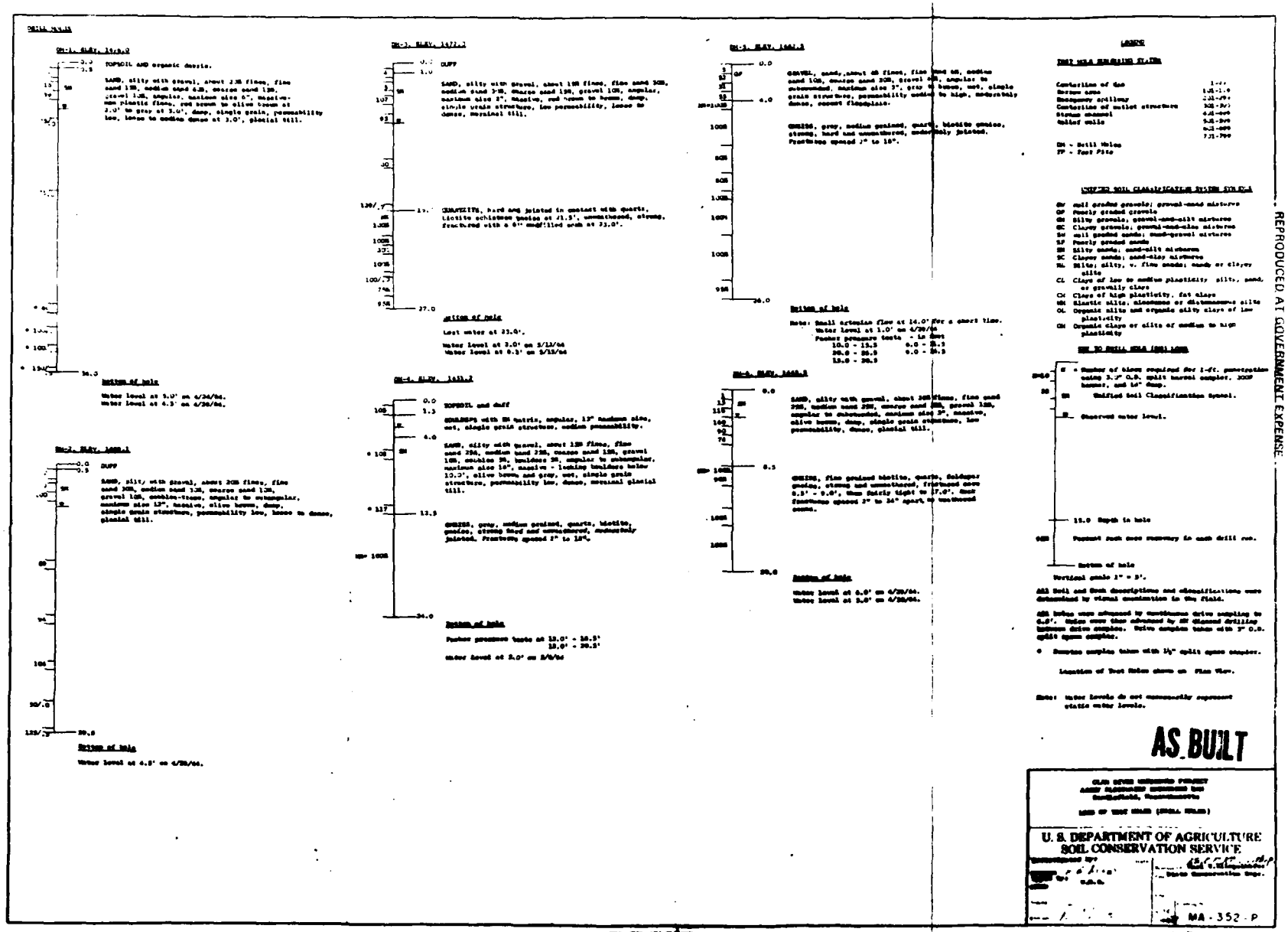
Vegetation is in good condition and does not appear to need lime and fertilizer. The top of dam and spillway should be mowed. Trash at the water's edge should be removed.

The dam top and spillway should be limed at a rate of two tons/acre and fertilized with 600 pounds of 5-10-10 or equivalent to maintain soil fertility.

James J. Elasmar
Project Engineer
SCS, Otis, Mass.

Ronald Thompson
District Conservationist
SCS, Pittsfield, Mass.




AS BUILT
U. S. DEPARTMENT OF AGRICULTURE
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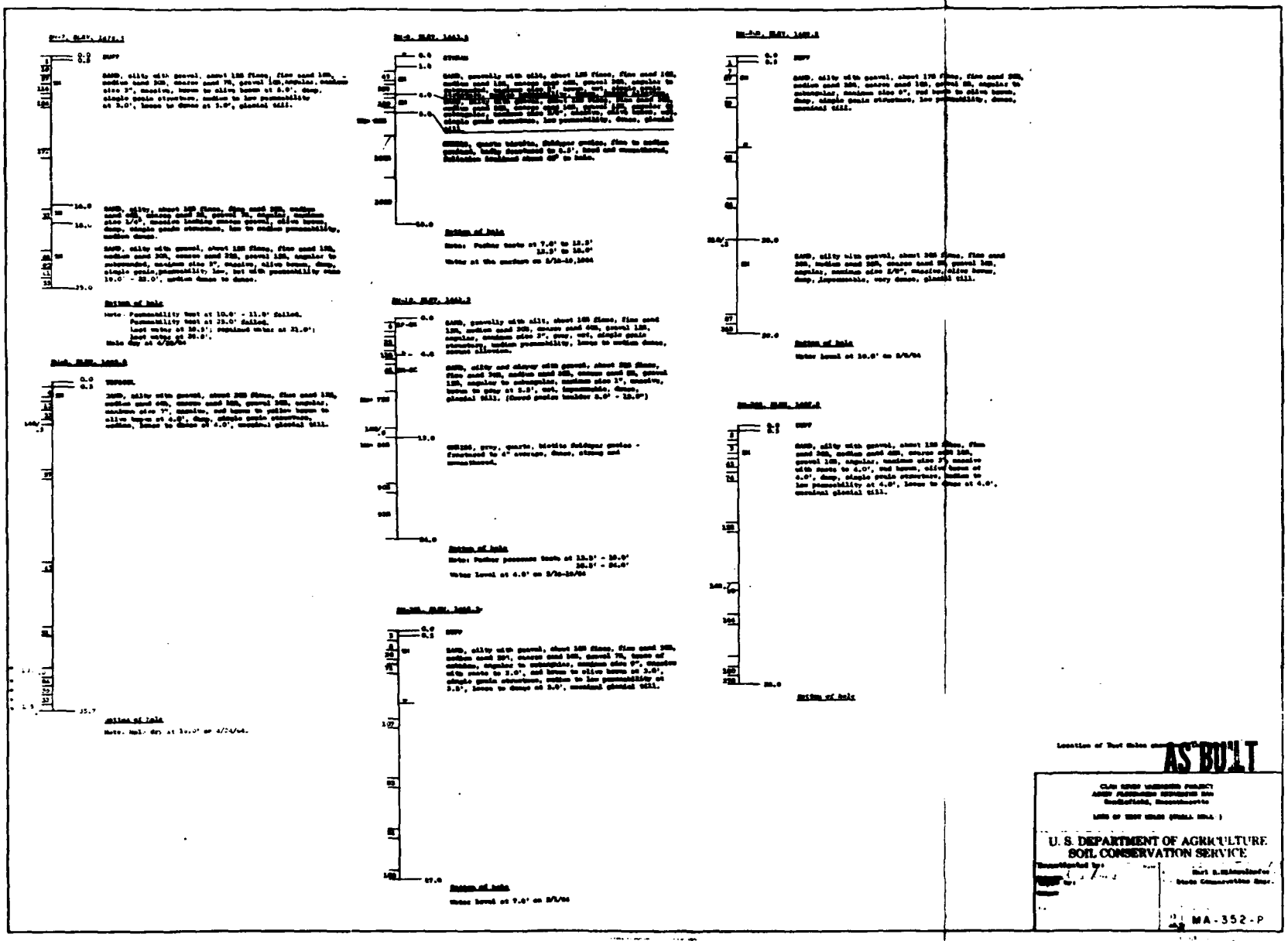
REPRODUCED AT GOVERNMENT EXPENSE



AS BUILT

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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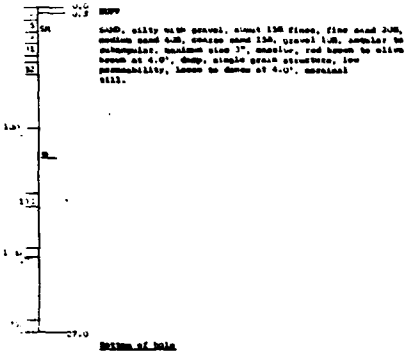
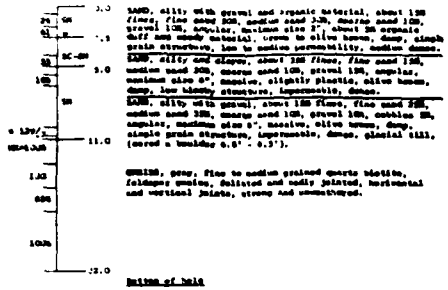


Bottom of hole

Water level at 13.5' on 5/14/64.

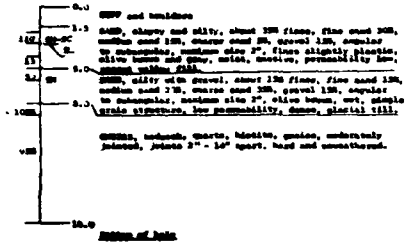


Bottom of hole

Packer pressure tests at 11.5' - 16.5'
16.5' - 21.0'

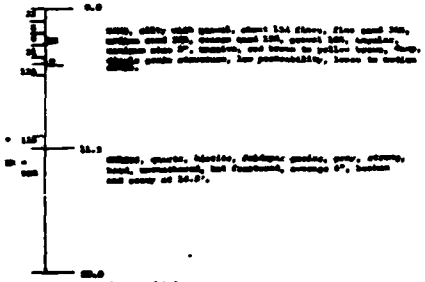
Note: Lost water at 17.5'

Water level at 2.5' on 5/13/64



Bottom of hole

Note: Packer test 10.5' - 16.0'
Water level at 3.0' on 5/6/64.



Bottom of hole

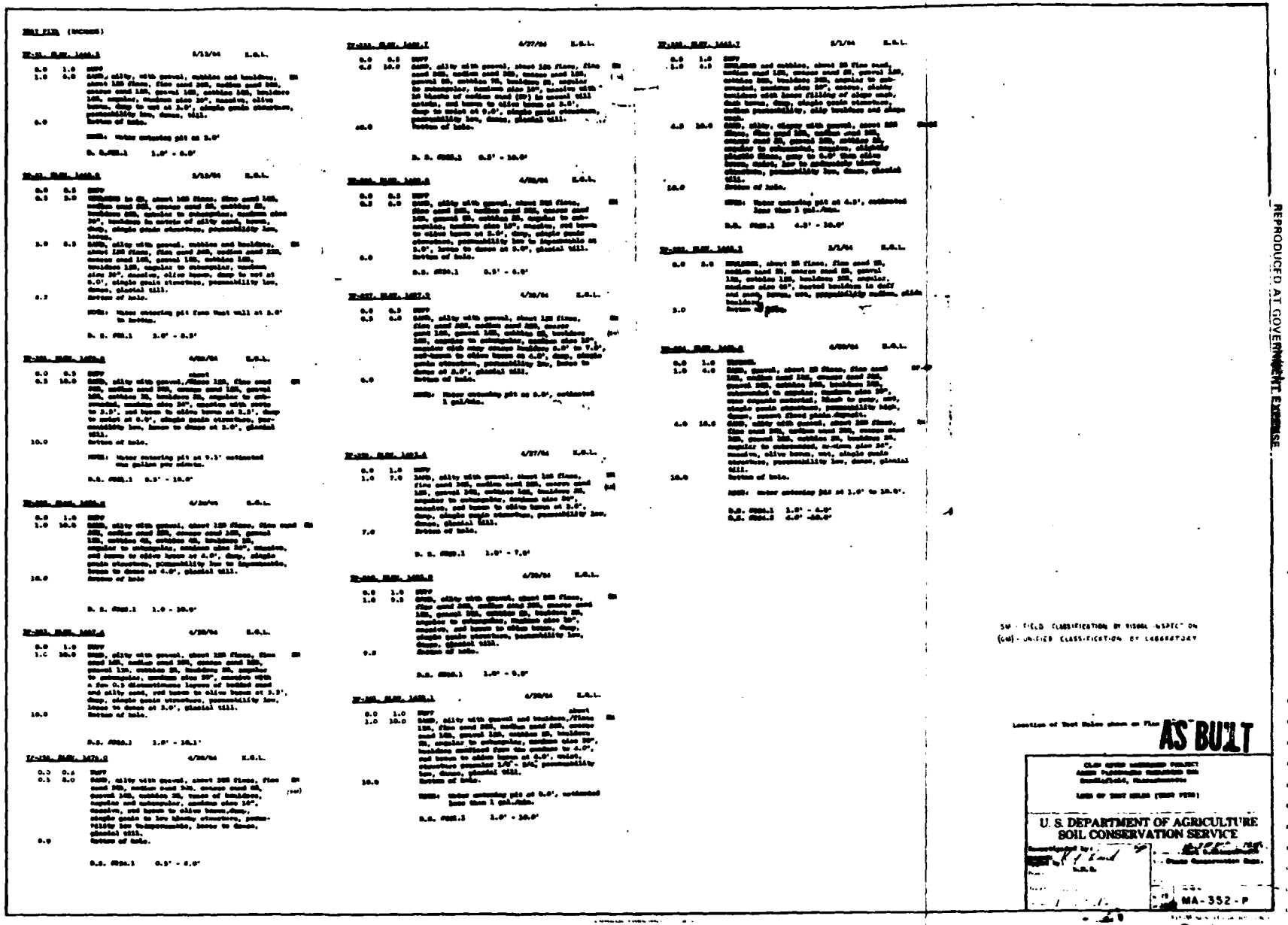
Note: Packer tests at 16.0' - 21.0'
Water level at 3.0' on 5/6/64

AS BUILT

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MA-352-P

B-12



SM - FIELD CLASSIFICATION BY VISUAL INSPECTION
(GM) - UNIFIED CLASSIFICATION BY LABORATORY

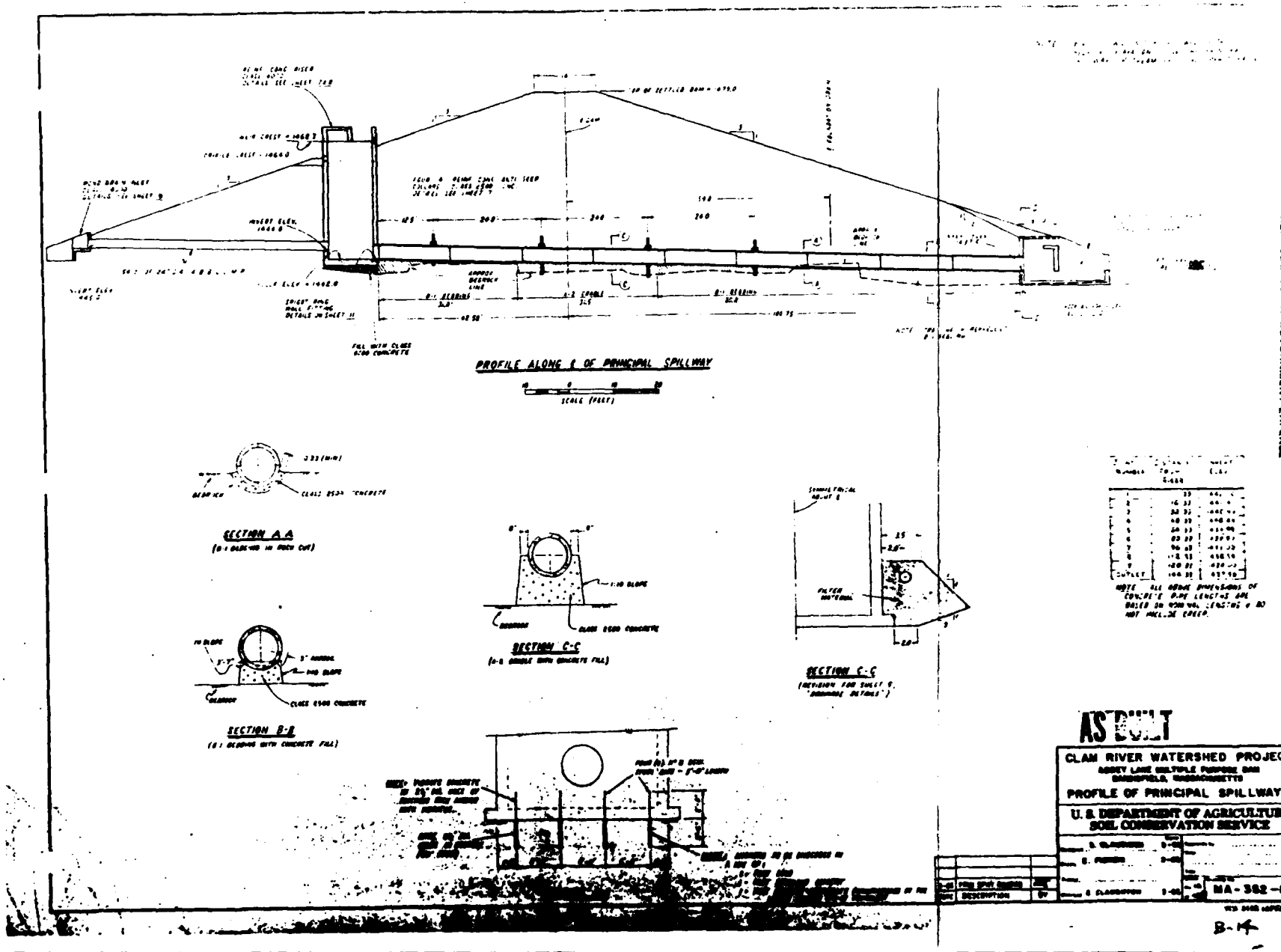
Location of Test Holes shown on Plan

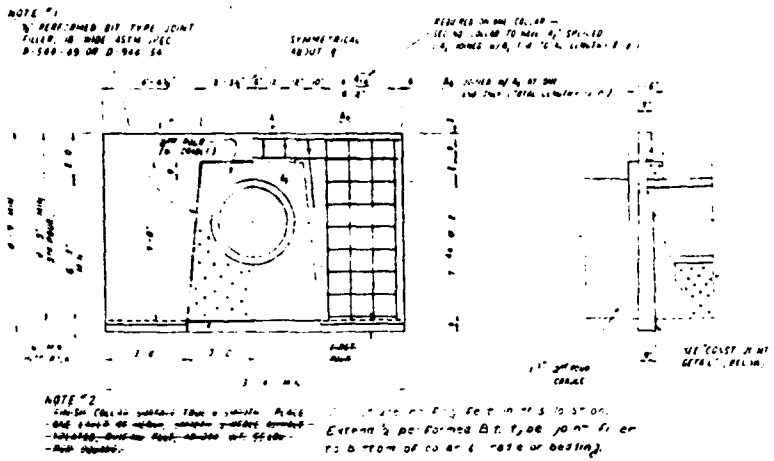
AS BUILT

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

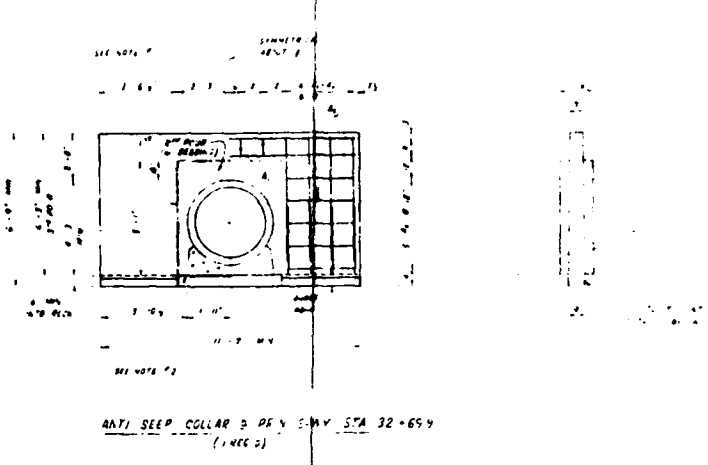
MA-352-P

B-13

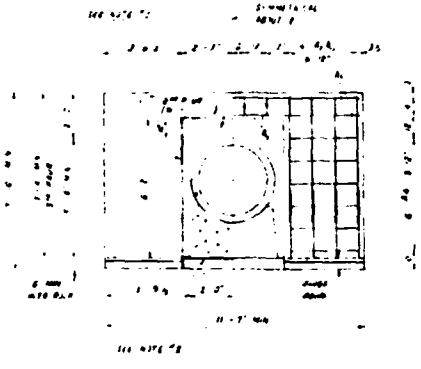




ANTI-SEEP COLLARS AT CRADLE
(2 REQ'D)



ANTI SEEP COLLAR @ PEN STRUCTURE STA 32+65.9
(1 REQ'D)



ANTI-SEEP COLLAR @ MAIN SPWY STA 33+41.9
(1 REQ'D)

CONST. JOINT DETAIL

AS BUILT

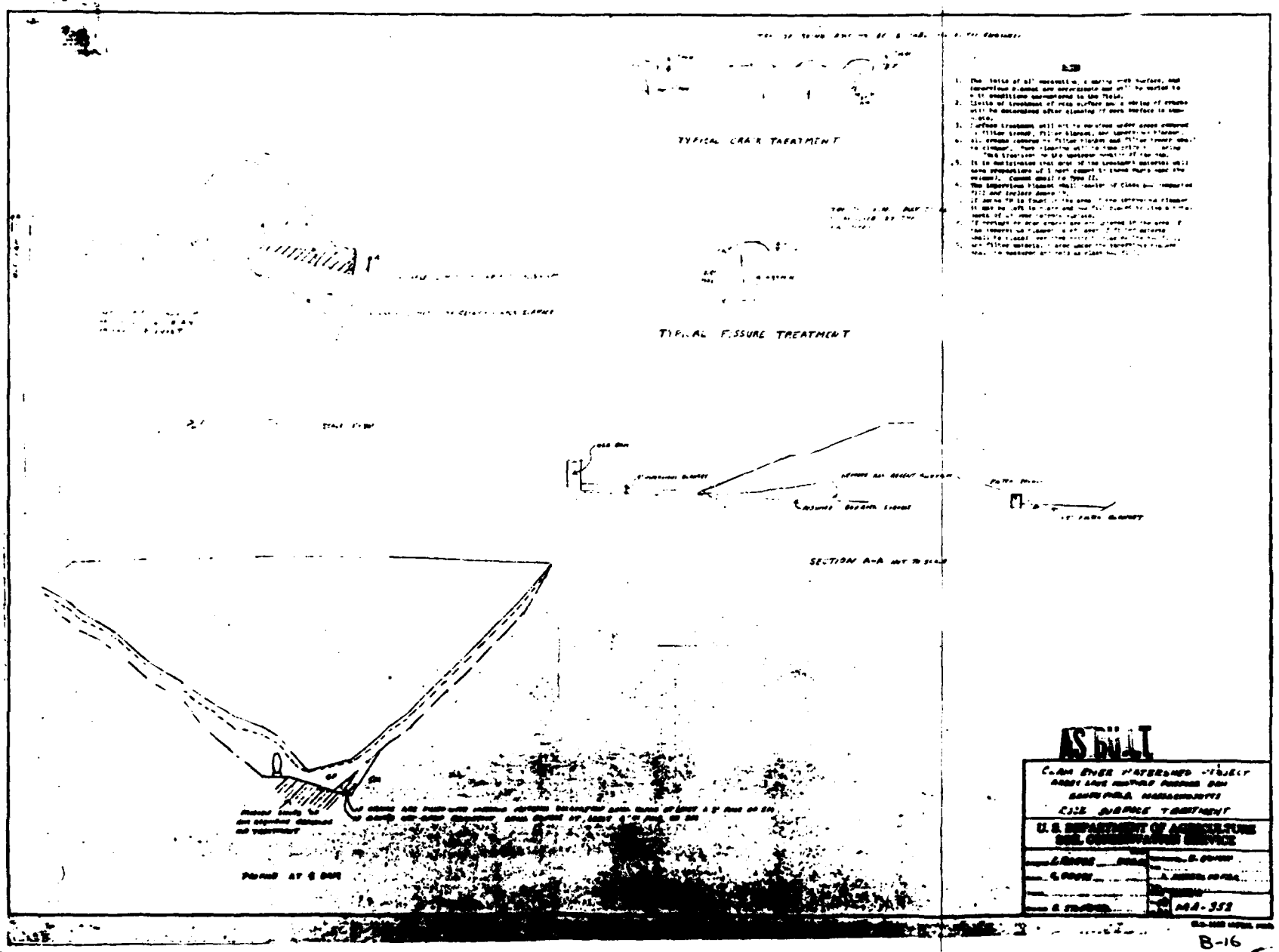
CLAM RIVER WATERSHED PROJECT
ABBEY LAKE MULTIPLE PURPOSE DAM
SHEFFIELD, MASSACHUSETTS

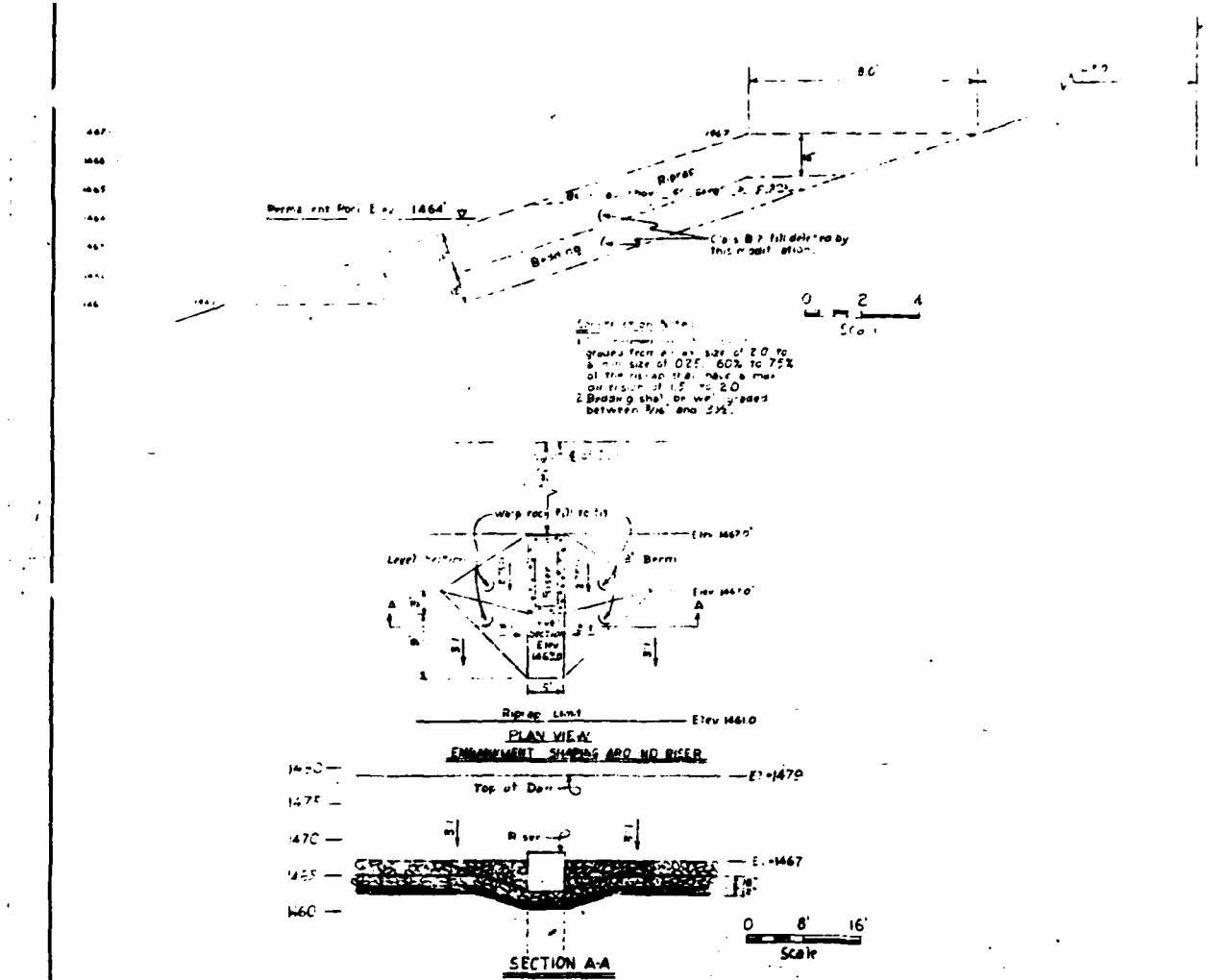
COLLAR STEEL SCHEDULE

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

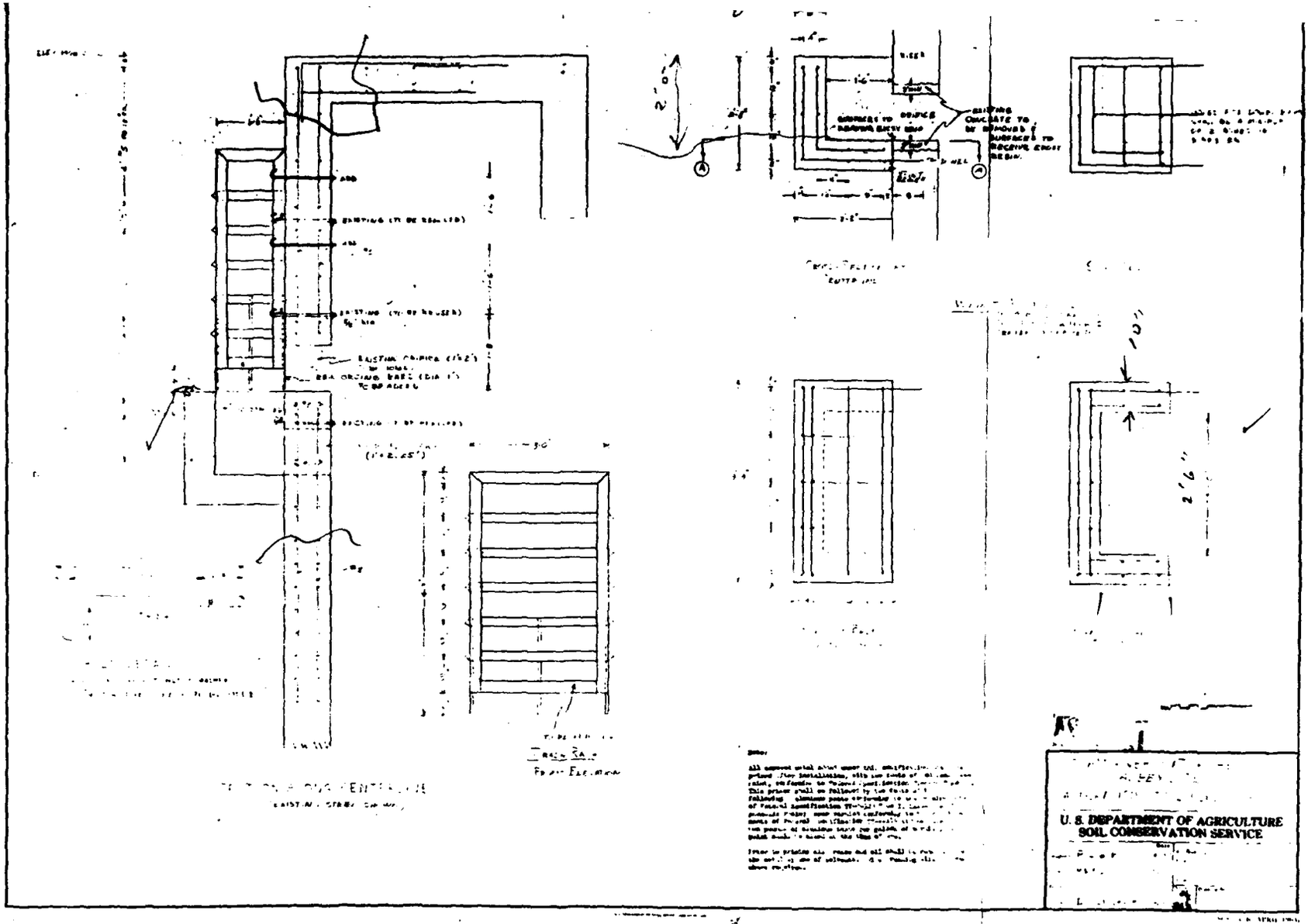
MA-352-P

B-15



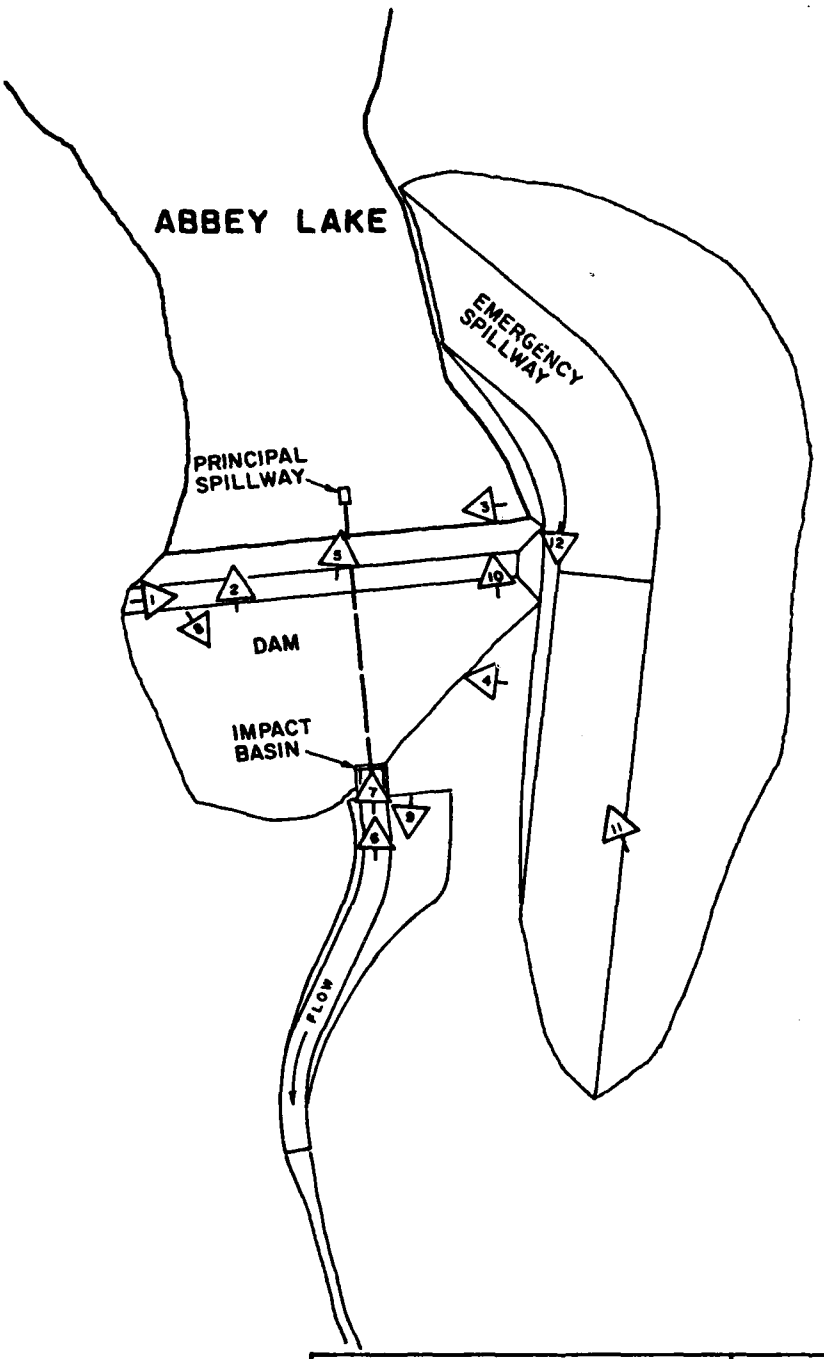


CLAM RIVER WATERSHED PROJECT
ABBEY LAKE MULTIPLE PURPOSE DAM
BRIMFIELD, MASSACHUSETTS
BERM REVISION
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MA 372



APPENDIX C

PHOTOGRAPHS



TIGHE & BOND / SCI CONSULTING ENGINEERS EASTHAMPTON, MASS.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

OVERVIEW (AERIAL)

APPENDIX C

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND ORIENTATION OF PHOTOS

ABBEY LAKE DAM (MA 00305)
BERKSHIRE COUNTY

SANDISFIELD
MASSACHUSETTS

SCALE: NONE

DATE: FEBRUARY 1980

Photo 1

Top of dam looking towards left abutment from right side.

Photo 2

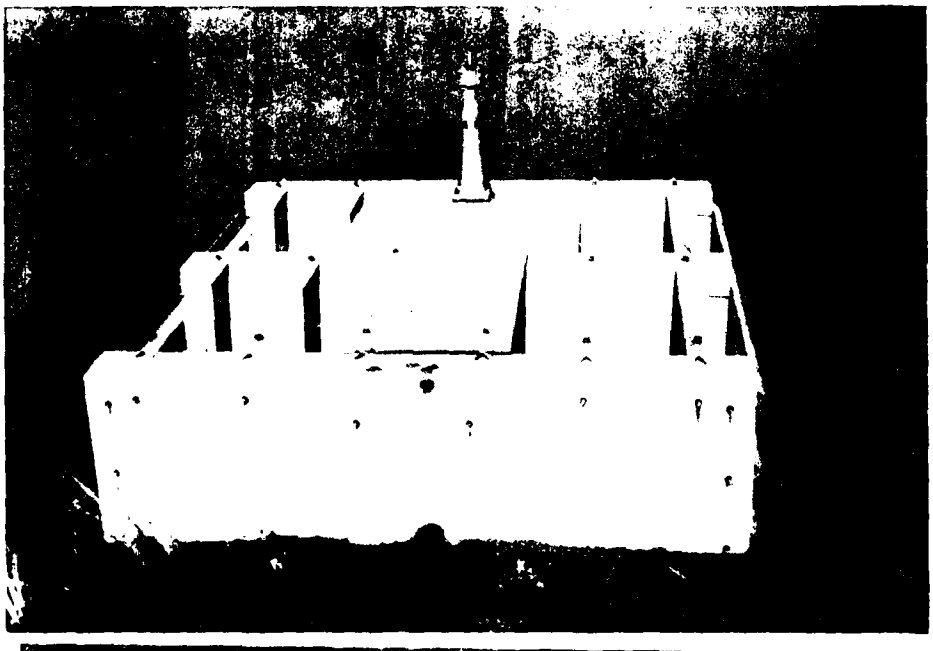
Overview of impoundment at recreation pool level.

Photo 3

Upstream embankment and principal spillway structure looking towards right abutment from center of dam.

face looking
ight abutment
side.

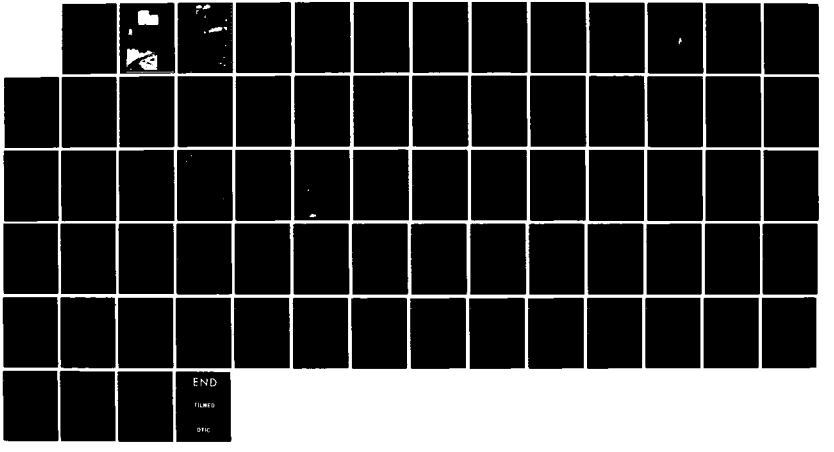
spillway drop
ucture.

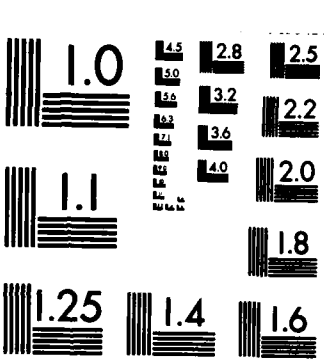


al spillway outlet
basin at downstream
nt toe.

AD-A154 495 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS ABBEY LAKE DAM MA 003.. (U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV FEB 80 2/2

UNCLASSIFIED F/G 13/13 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Photo 7

Principal spillway outlet conduit at impact basin.

Photo 8

Overview of downstream embankment and discharge channel looking from top of dam, right side.

Photo 9

Discharge channel looking downstream from impact basin.

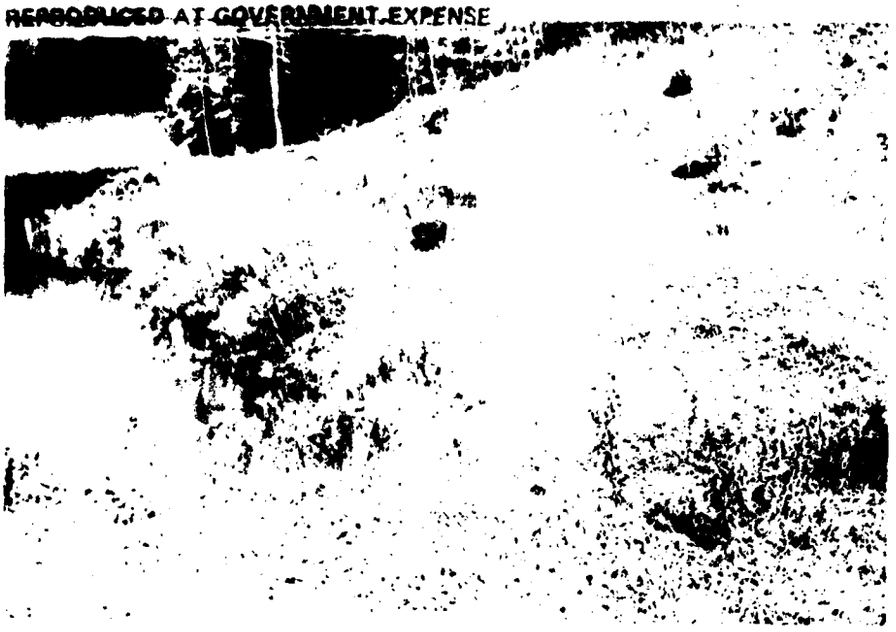


Photo 10

Emergency spillway approach channel inlet looking from left end of dam.

Photo 11

Emergency spillway control section and left side of dam looking from left side of discharge channel.

Photo 12

Emergency spillway discha channel, receiving area, right training embankment looking from left side of dam.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

Appendix D

Hydrologic & Hydraulic Calculations

Index

Size & Hazard Classification

Dam data: reference S.C.S. "As Built" Plans dated 1965

original stream channel elev. = 1439.5
top of dam elev = 1479
height of dam = 39.5 ft.

Outlet Elevations

a) Principal spillway low stage orifice: 1.0' H x 2.25' W inv. elev = 1462.2

b) Principal spillway high stage overflow weirs: 4 broad crested weirs each at 4'-6" long w/2 end contractions. elev = 1668.3

c) Emergency spillway: sod covered earth excavated channel spillway with a 50 ft wide x 30 ft long control section elev. = 1472

Storage Volume Vs. Pool Elevation:

data on storage vs. pool elevation has been taken from the S.C.S. design book, "General Section".

	Elev.	Storage	Surface Area
	1462.2*	154 acre-ft	36 acres*
	1468.3	387 " "	41.5 "
	1472.0	546 " "	45 "
TOP DAM	1479.0	889 " "	52.7 "

* The original S.C.S. design set the low stage orifice at inv. elev. 1464. A revision lowered the orifice to inv. 1462.2. The design book was not revised. The surface area of 36 acres has been estimated

∴ Maximum Storage = 889 acre-ft.

Classification :

Height = 39.5 ft < 40 → small

Storage = 889 acre-ft < 1000 → small

∴ Size Classification is Small

Hazard :

The hazard potential is high due to the Village of Montville being about 2 miles downstream. More than a few homes are located within close proximity to the receiving stream. In addition there are 2 bridges located on West St, and 1 bridge located on Rt. 57 just upstream of Montville.

The S.C.S design book calculates a structure Class "C" with an estimated 100 people in damage area.

∴ Hazard is High

Test Flood Selection:

Small Size - High Hazard

Ref "Recommended Guidelines For Safety Inspection of Dams, COE, Nov. 76

The test flood should be ½ PMF to PMF

The test flood selected for the West Lake Dam which has the same downstream damage areas a Abbey Lake, was the full PMF due to its "Intermediate Size". West Lake Dam is on the low end of the intermediate size class at 1133 acre-ft of maximum storage. Abbey Lake Dam is on the high end of the Small size class at 889 acre-ft of maximum storage.

∴ As the initial selection use the full PMF & check the hazard potential after the dam failure analysis is completed.

Spillway Adequacy Analysis

References:

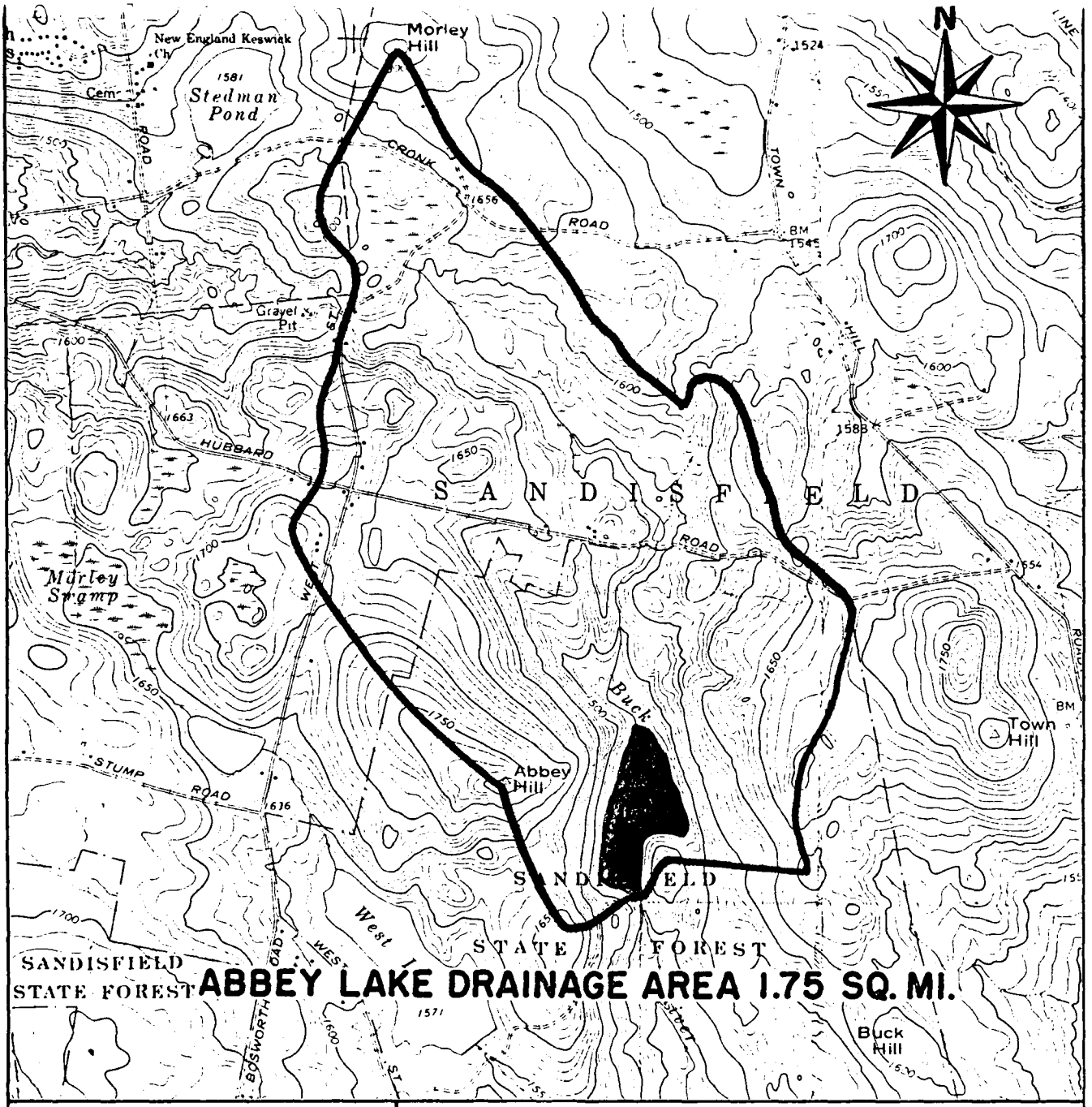
1) S.C.S. Design Report
2) S.C.S. "As Built" Drawings
3) Recommended guidelines for safety inspections of dams, COE, Nov. 1976
4) Preliminary guidance for estimating Maximum Probable Discharges in Phase I dam investigations, COE, March 1978.
5) U.S.G.S. quadrangle sheets.

Ⓐ Test Flood Determination:

Abbey Lake Drainage Area = 1.75 mi^2
Terrain is mountainous

Extrapolation of COE guidance curve to a D.A. = 1.75 mi^2 with mountainous terrain results in unit discharge of 2575 CFS/mi^2 (See page 2)

M.P.F. = 1.75 mi^2 × 2575 CFS/mi^2 = 4,500 CFS



-SCALE-

1000' 0 1000' 2000' 3000'

FROM: U.S.G.S. MONTEREY, MASS. QUADRANGLE MAP

QUADRANGLE LOCATION

TIGHE & BOND / SCI CONSULTING ENGINEERS EASTHAMPTON, MASS.	U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

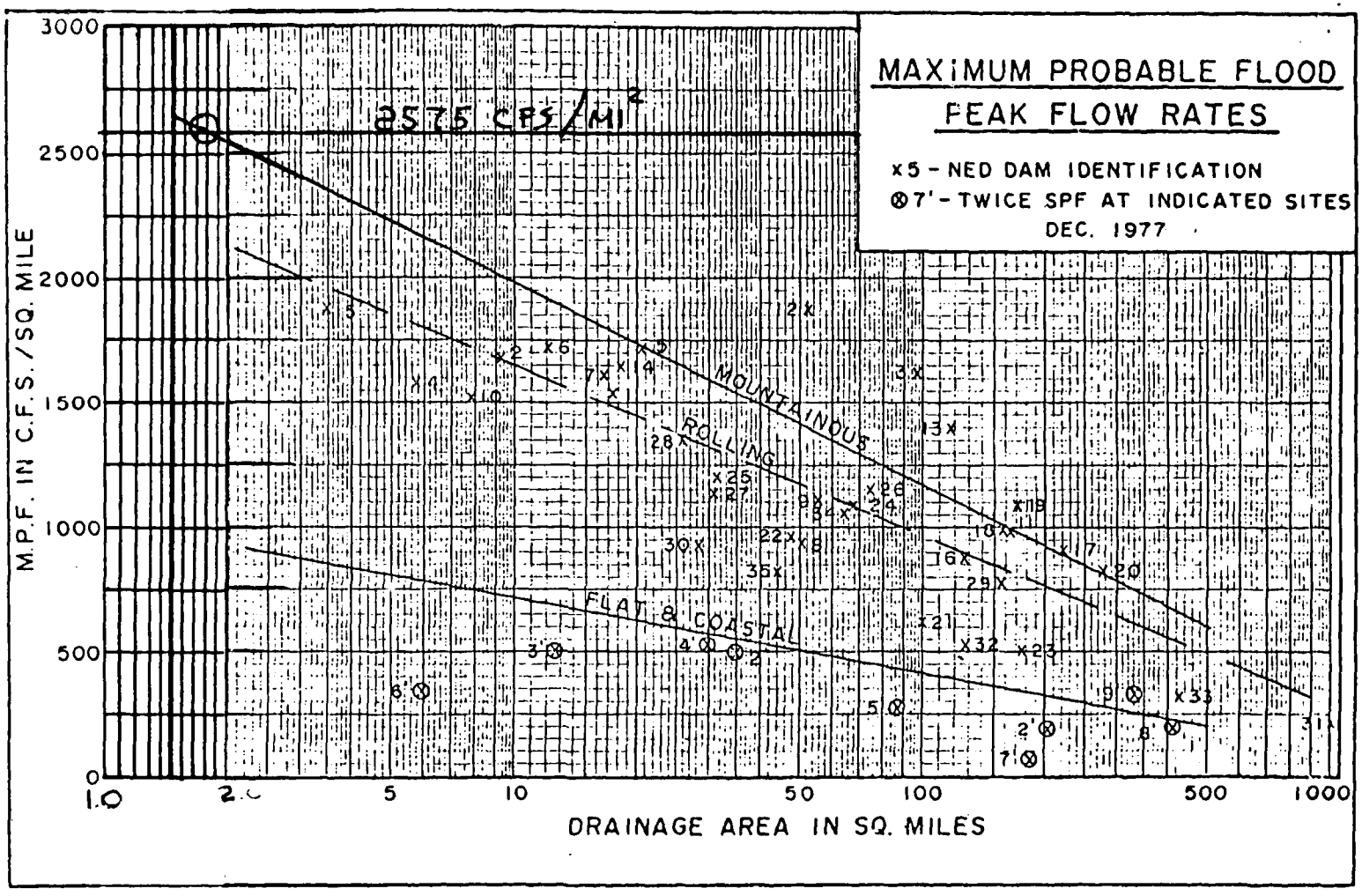
DRAINAGE AREA MAP

ABBEY LAKE DAM (MA 00305)
BERKSHIRE COUNTY

SANDISFIELD
MASSACHUSETTS

SCALE: AS NOTED

DATE: FEBRUARY 1980



Extrapolation of COE Guidance Curve For M.P.F.

(B) Spillway Capacity:

There a 3 outlets from the pond

1) Principal Spillway low stage orifice
2) " " high stage weirs
3) Emergency Spillway channel.

The S.C.S. Design Report includes calculations for the discharge rate of each spillway outlet vs. the Pond elevation up to and including the crest of the dam. These calculations have been reviewed, and determined to be valid and correct, and, therefore, have been used to compare the spillway capacity against the Test Flood.

tabulated discharge rates vs. Pond elevations are as follows:

Note: The elevation of the low stage inlet was lowered from 1464 as originally designed to 1462.2. This change is

⑤ Route 57 Crossing 17,900 ft. D.S

Q before = 11,700 CFS :

The depth due to the natural stream channel would be about 8 ft. The roadway bridge is estimated to have a surcharge capacity of about 2000 CFS, therefore, the bridge will be overtopped

Q after = 22,000 CFS

The depth due to the natural stream channel would be about 11 feet. This will increase the depth of flow over the bridge by about 3 feet. Spillage long South side of Rt 57 will cause minor flooding of 1 house.

∴ Before Failure : Bridge overtopped

after Failure : Increase over bridge = 3± ft
1 house flooded 1-2 ft

⑤ Village of Montville Area along Rt 57
Beginning 11,600 ft D.S. to 14,100 ft D.S

Q before = 11,700 CFS : Depth = 5½ ft

There are 3 houses which are only a few feet above the stream channel which will be flooded by 2± feet.

Q after = 22,200 CFS ; Depth = 8 ft

The 3 houses previously flooded 2±ft will now be inundated in about 5 ft of water. 2 additional houses will be flooded by 3± ft of water.

∴ Before Failure : 3 houses flooded 2± ft

After Failure : 3 houses flooded 5± ft
2 houses flooded 3± ft

Q after = 21,200 CFS

The depth due to the natural stream channel would be about 14 feet. This will increase the flooded depth over the bridge and the 3 houses by at least 3 feet. 1 additional house will probably be flooded by a few feet of water.

∴ Before Failure : Bridge overtopped.
3 houses flooded 3± ft

After Failure : increase over bridge = 3 ft
3 houses flooded 6± ft
1 house flooded 2± ft

Q after = 22,400 CFS

The depth due to the natural stream channel would be about 10 ft. The road culvert which was inundated prior to the breach will be severly overtopped.

④ Route 57 Crossing 9,600 ft. D.S.

Q before = 8700 CFS

The depth due to the natural stream channel would be about 11 ft. The RT. 57 bridge has a low cord height of about 5 ft above the stream channel and a surcharged capacity of 1930 CFS. The bridge will be overtopped.

There are 3 houses located upstream of the bridge which are less than 10 feet above the stream channel. These will be flooded by about 3 feet.

Q after = 17,400 CFS

The depth due to the natural stream channel would be about 8 ft. The road culvert which was inundated prior to the breach will be severely overtopped.

③ West Street Crossing 6,600 ft D.S.

The tributary flow from West Lake Dam plus additional drainage area South of West Lake converges with the Buck River just upstream of Area C.

Q before = 8700 CFS

The depth due to the natural stream channel would be about 7 ft, however, the road culvert has a surcharged capacity of 1030 CFS which is greatly exceeded. The culvert will be inundated and the roadway overtopped.

Summary Of Downstream Conditions With Dam Failure

The following area designation numbers refer to the "Location and Downstream Hazard Maps".

① Downstream of Dam

Q before = 2900 CFS ; Depth = 4.5 ft.
Q after = 19,650 CFS ; Depth = 9.0 ft

no significant damage before or after dam failure.

② West Street Crossing 4,600 ft. D.S.

Q before = 2900 CFS :
The depth due to the natural stream channel would be about 4.5 ft, however, the road culvert has a surcharged capacity of 325 CFS which is greatly exceeded. The culvert will be inundated and the roadway overtopped.

Calculated Q out utilizing storage capacity = 3180 CFS for full PMF inflow = 4500 CFS.

Combined spillways capacity at top of dam = 2900 CFS

$\frac{2900}{3180} = 91\%$ of full PMF

In accordance with COE guidelines the test flood ranges from ½ PMF to full PMF. The spillway can handle up to 91% of the full PMF, therefore, it is concluded to be adequate

½ PMF = 2250 CFS → This can be safely discharged without utilizing available storage.

Flood Routing

① $Q_{P_1} = 4500$ CFS

$Elev_1 = 1480.18$

$Stor_1 = 560$ acre-ft

560 acre-ft ÷ 1120 acres = 0.5 ft = 6"

$Q_{P2} = 4500\left(1 - \frac{6}{19}\right) = 3082$ CFS

② $Q_{P2} = 3082$ CFS

$Elev_2 = 1479.18$

$Stor_2 = 510$ acre-ft

Average Stor $= \frac{530 + 510}{2} = 520$ acre-ft

520 acre-ft ÷ 1120 acres = 0.464 ft = 5.57"

$Q_{P3} = 4500\left(1 - \frac{5.57}{19}\right) = 3181$ CFS

③ $Q_{P3} = 3181$ CFS

$Elev_3 = 1479.22$

$Stor_3 = 520$ acre-ft

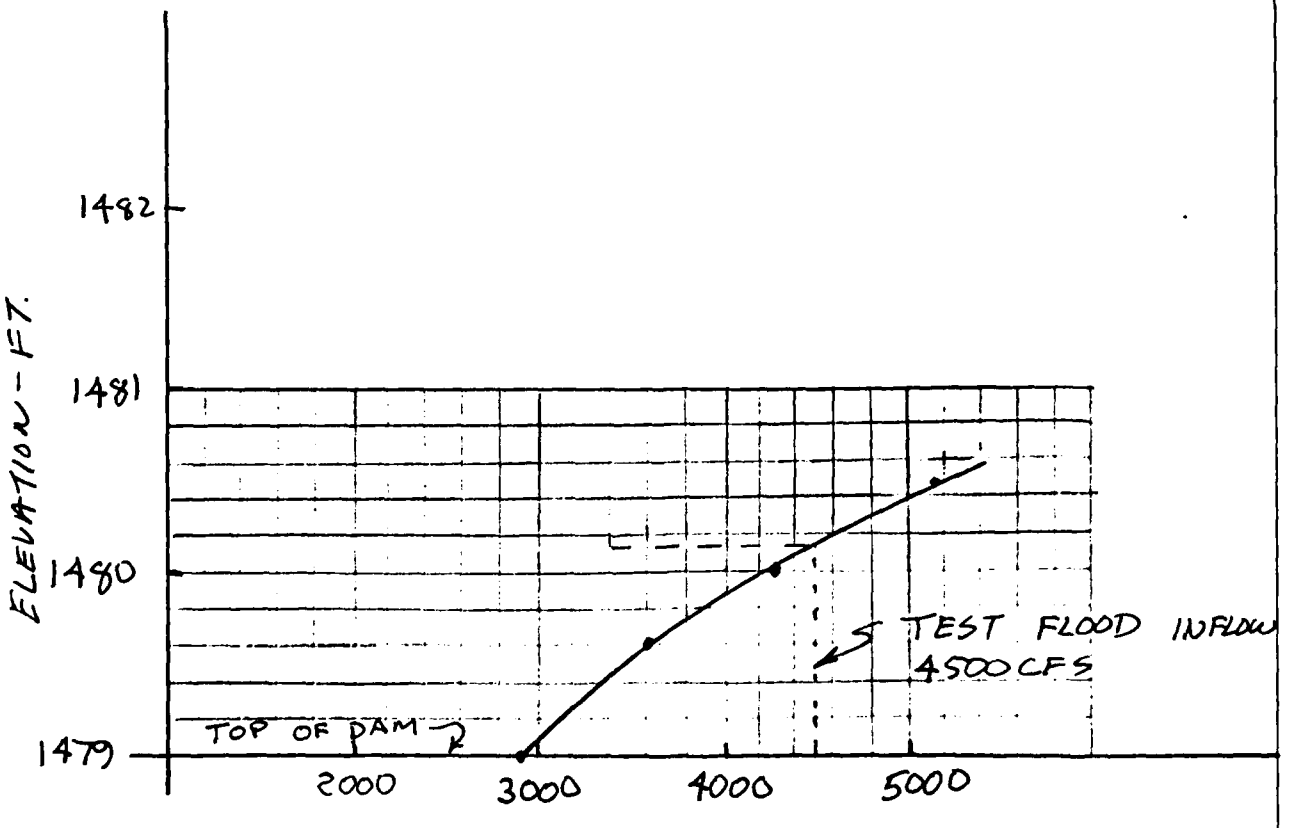
Average Stor $= \frac{520 + 520}{2} = 520$ acre-ft

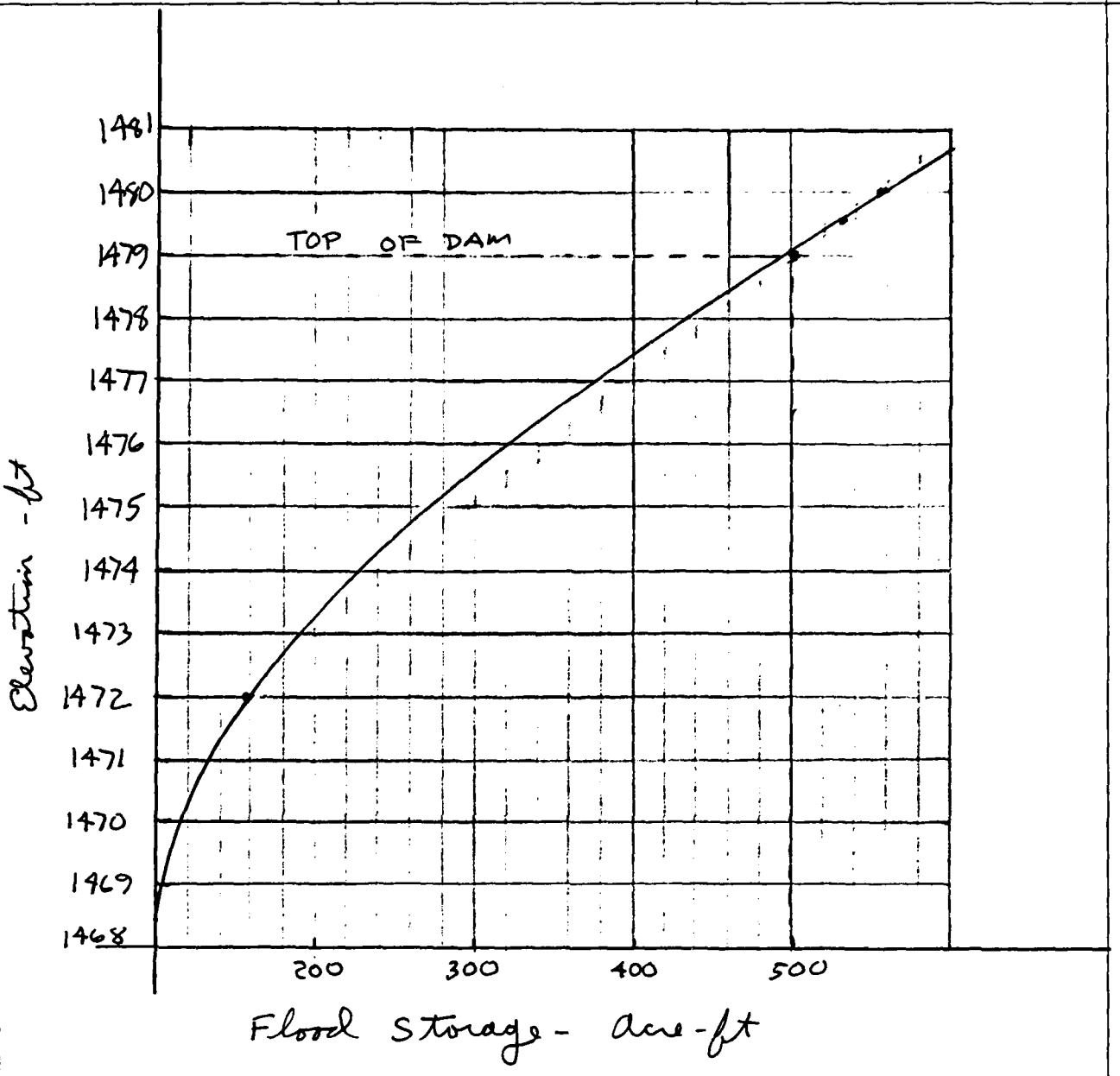
Same as Trial #2

∴ Q out = <u>3180 CFS</u>

OHD 2/3/80
MOC

H	C	L	$H^{3/2}$	Q
0.2	3.1	210	0.089	57
0.4	↓	↓	0.252	164
0.6			0.465	303
0.8			0.715	465
1.0			1.0	651
1.5			1.837	1195
2.0			2.828	1841
2.5			3.953	2573





Broad Crest Weir Flow Over Dam:

Crest width = 14 ft

$Q = C L H^{3/2}$

reference for "C": Design of Small Dams
U.S. Dept of Interior, 1973

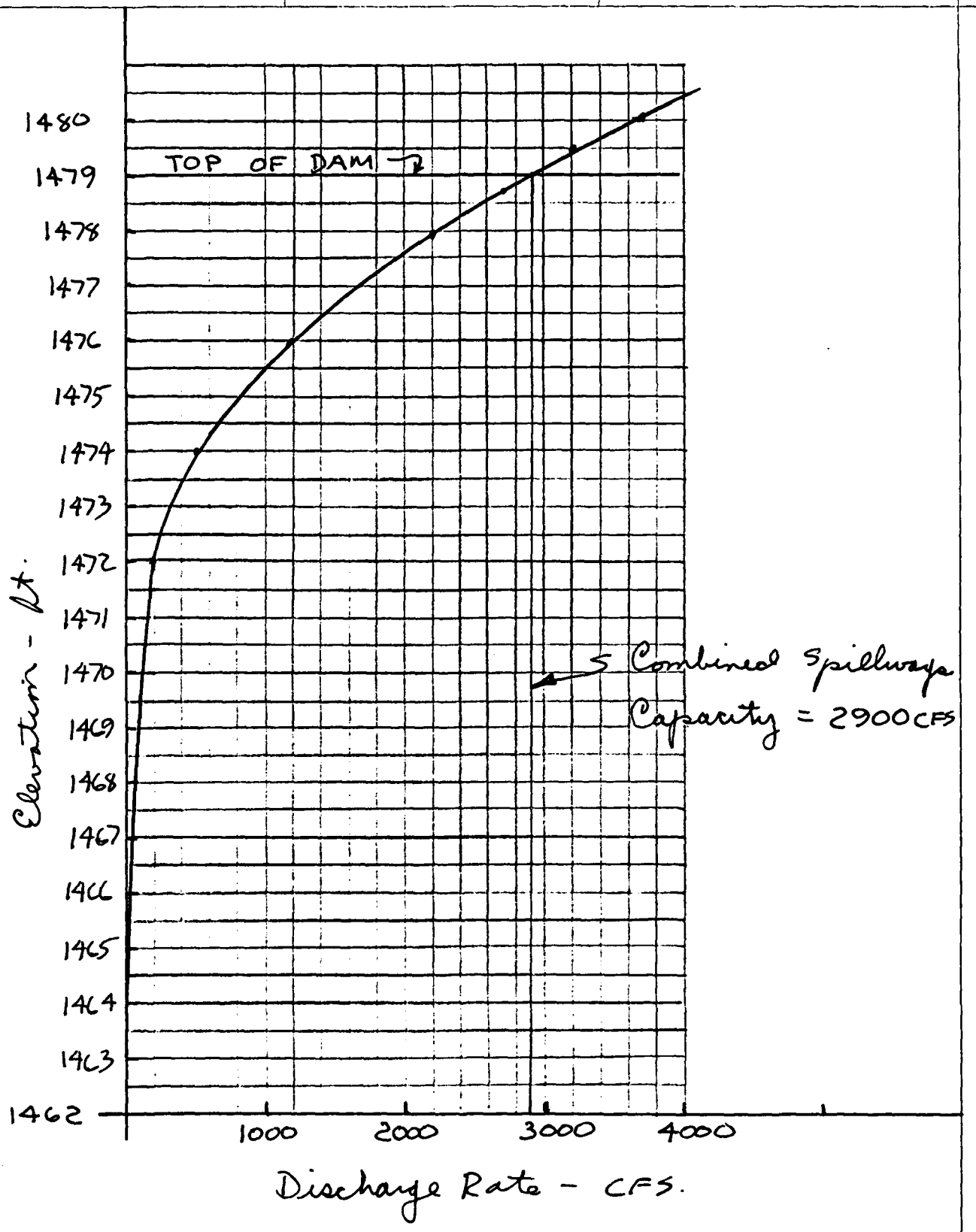
© Estimated Effects of Surcharge Storage On Test Flood Outflow

Test Flood inflow = 4500 CFS

Assume that the pond elevation is at the crest of the high stage overflow weirs at the start of the storm.

Elev. = 1468.3 − Storage = 0

Elev.	Surface Area	Storage
1468.3	41.5 acres	0
1472.0	45 "	159 acre-ft
1479.0	52.7 "	502 " "
1479.5	53 "	528 " "
1480.0	54 "	555 " "


1480
1479
1478
1477
1476
1475
1474
1473
1472
1471
1470
1469
1468
1467
1466
1465
1464
1463
1462
TOP OF DAM
Elevation - ft.
Combined Spillways
Capacity = 2900 CFS
1000
2000
3000
4000
Discharge Rate - CFS.

Elev.	① Orifice	② Weir	①+② Pipe	③ Emerg. Spill.	Total
1462.2	0	0	0	0	0
1462.7	–	↓	–	↓	–
1463.2	8		8		8
1464.2	14		14		14
1465.2	18		18		18
1466.2	21		21		21
1467.2	24	↓	24	↓	24
1468.3	27	0	27	0	27
1469.0	28	33	61	↓	61
1470.0	30	124	154		154
1470.2	31	146	177		177
1470.4		170	179		179
1470.6		195	180		180
1470.8		221	180		180
1471.0		248	181		181
1472.0		397	184	0	184
1473.06			187	100	287
1473.50			189	200	389
1473.97			190	300	490
1475.87			195	1000	1195
1477.02			199	1500	1699
1477.96			201	2000	2201
1478.74			203	2500	2703
1479.47			205	3000	3205
1480.18			207	3500	3707

not reflected in the S.C.S. spillway discharge computations, however, the modification has no effect on the flood flow capacity of the principal spillway. The 36 inch outlet conduit becomes the hydraulic control at water level elevations above 1470 ± . The tabulation presented herein includes the spillway capacities with the low stage inlet modification.

⑦ Confluence With Clam River 19,600 ft DS

a) Upstream of Confluence

Q before = 14,600 cfs : Depth = 10½ ft

There are 2 houses which are less than 10 feet above the stream channel. These will be flooded by 4± feet of water.

Q after = 23,300 cfs : Depth = 13 ft

The 2 houses previously flooded by about 4 feet are now flooded to about 6½ feet of water. 1 additional house is located about 10 feet above the stream channel and will be flooded by 3± ft of water.

∴ Before Failure : 2 houses flooded 4± ft

after Failure : 2 houses flooded 6½ ft
1 house flooded 3± ft

B) Downstream of Confluence.

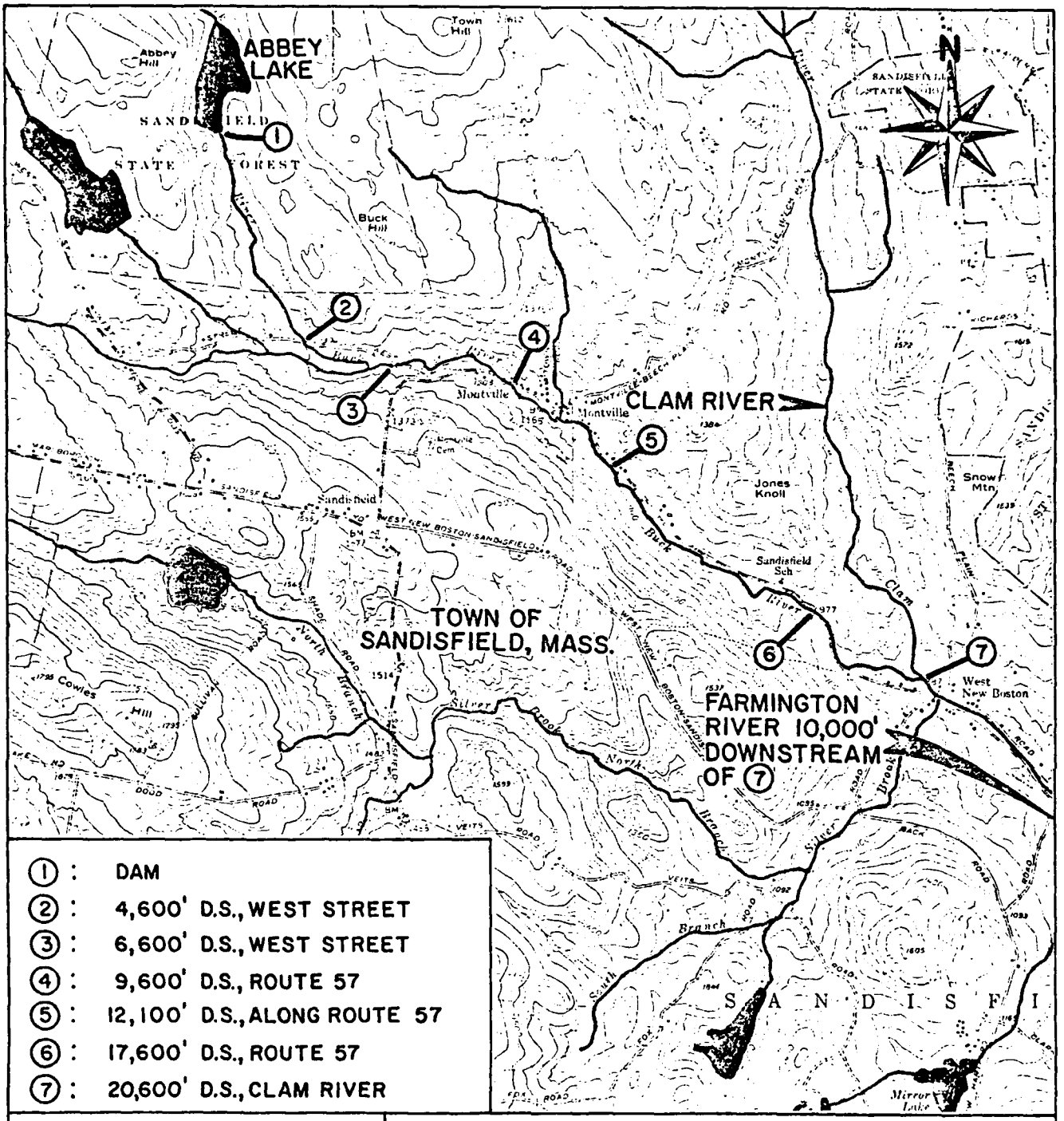
Q before = 29,600 CFS ; Depth = 14½ ft

Q after = 38,300 CFS ; Depth = 15½ ft

The additional 1 foot of flooded depth will not significantly add to the damage potential.

Total Damage Potential:

	Before Failure	After Failure
②	Secondary Road Culvert Overtopped.	overtopping increased 3½ ft
③	Secondary Road Bridge Overtopped	overtopping increased 3 ft.
④	Primary Road Bridge Overtopped	overtopping increased 3 ft
	3 houses flooded 3 ft	3 houses flooded 6 ft
		1 house flooded 2 ft
⑤	3 houses flooded 2 ft	3 houses flooded 5 ft
		2 houses flooded 3 ft
⑥	Primary Road Bridge Overtopped	overtopping increased 3 ft.
		1 house flooded 2 ft
⑦	2 houses flooded 4 ft	2 houses flooded 6½ ft
		1 house flooded 3 ft



- SCALE -

1000' 0 1000' 2000' 3000' 4000' 5000'

FROM: USGS MONTEREY, OTIS, SOUTH SANDISFIELD, AND TOLLAND CENTER, MASS. QUADRANGLE MAPS

(4) QUADRANGLE LOCATIONS

TIGHE & BOND / SCI
CONSULTING ENGINEERS
EASTHAMPTON, MASS.

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LOCATION AND DOWNSTREAM HAZARD MAP

ABBEY LAKE DAM (MA 00305)
BERKSHIRE COUNTY

SANDISFIELD
MASSACHUSETTS

SCALE: AS NOTED

DATE: FEBRUARY 1980

Downstream Conditions With Dam Failure

reference: "Rule of Thumb" Guidance For Estimating Downstream Dam Failure Hydrographs, COE, April 1978.

(A) Reservoir storage @ Failure = 889 acre-ft

(B) Length of dam at mid-height is about 132 ft

$\therefore$ 40% = 0.4 × 132 = 52.8 ft

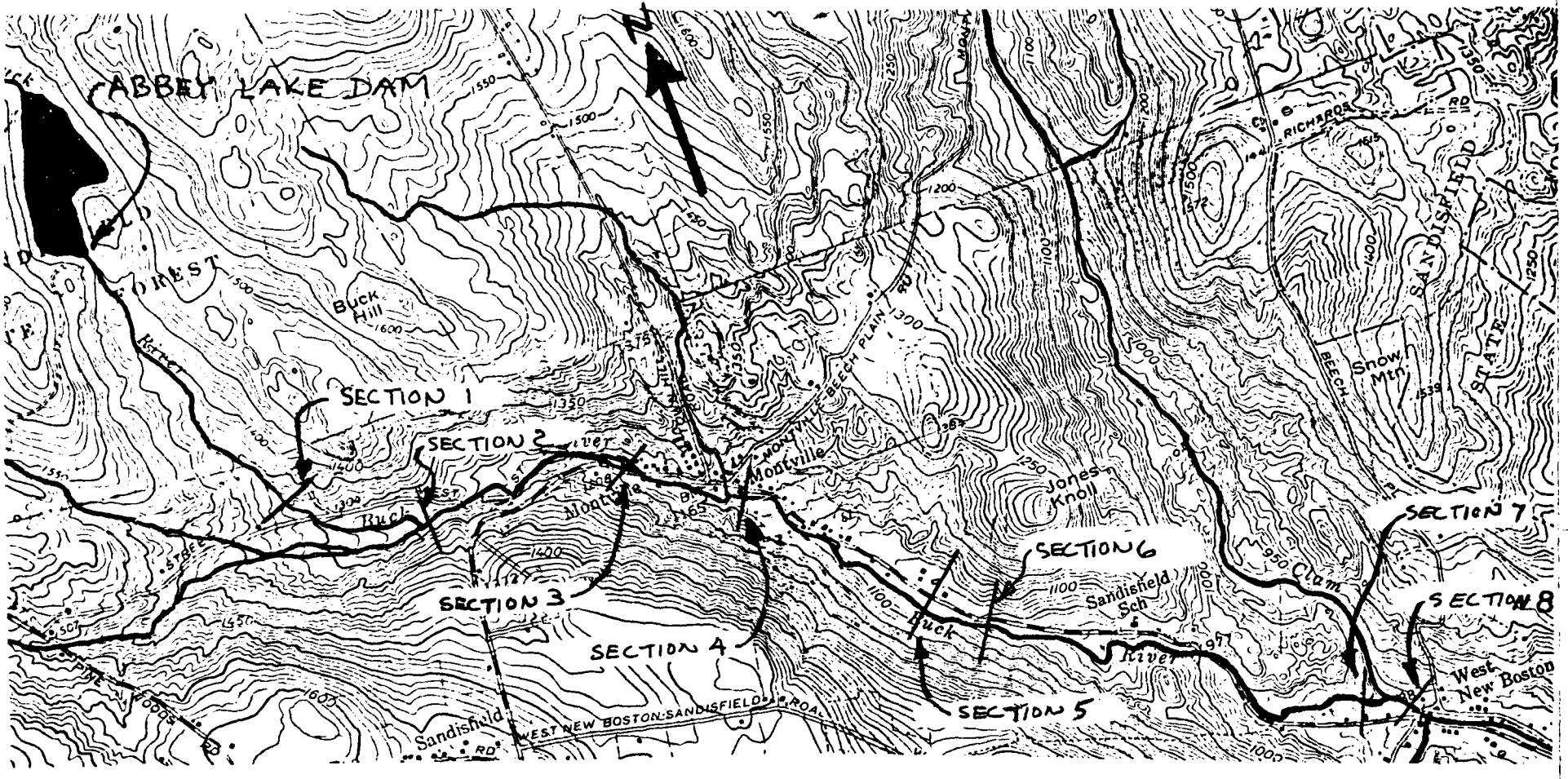
use 53 ft

(C) Depth of Water = 36.5 ft (top @ $\mathcal{L}$ of dam)

(D) Peak Failure Outflow:

$$Q_P = \left(\frac{8}{27}\right)(53') \times \sqrt{32.2} \times (36.5)^{3/2}$$

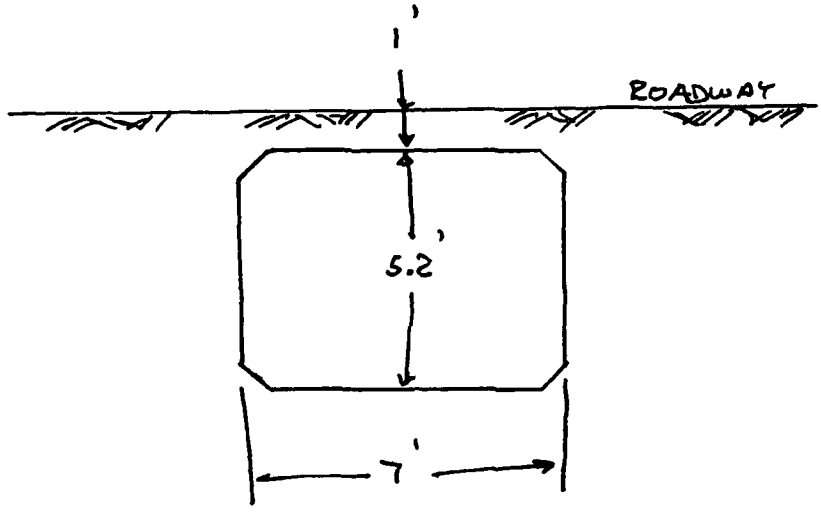
$$Q_P = 19{,}650 \text{ CFS}$$



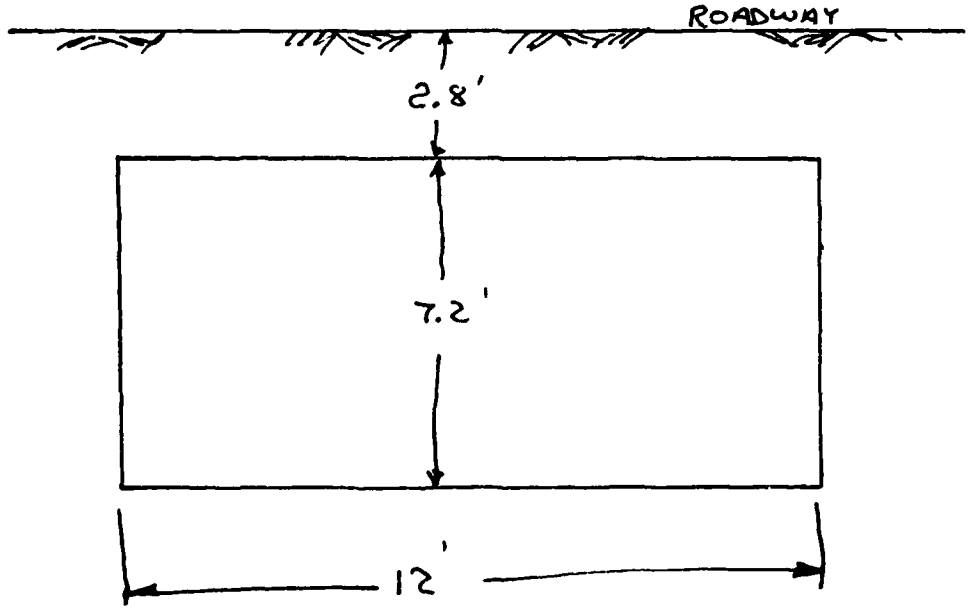
Downstream channel conditions : USGS 1:24,000
1" = 2000'

(E) Existing Culverts & Bridges : See Capacity Calcs. in Section (G).

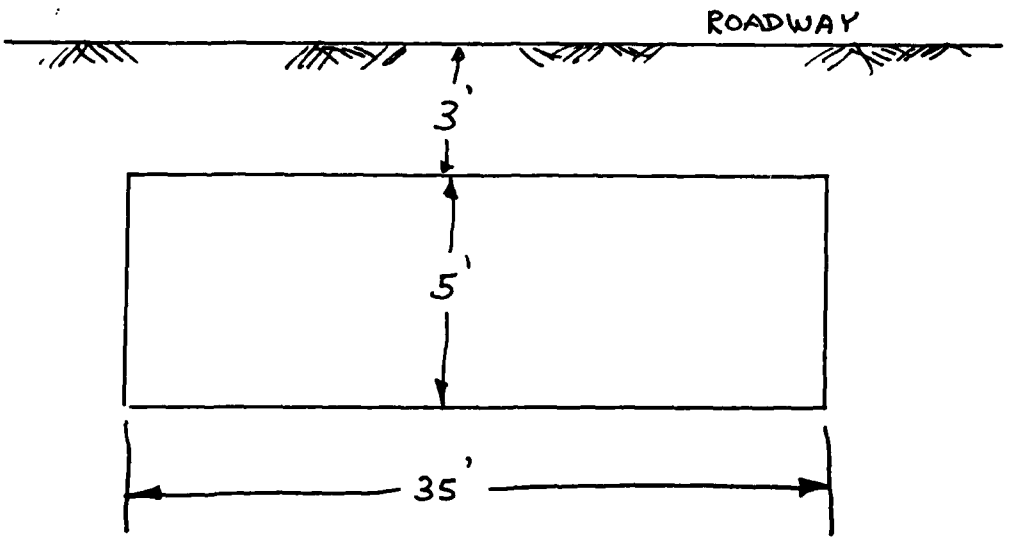
1. Box Culvert #1 : West Street



2. Box Culvert #2 : West Street

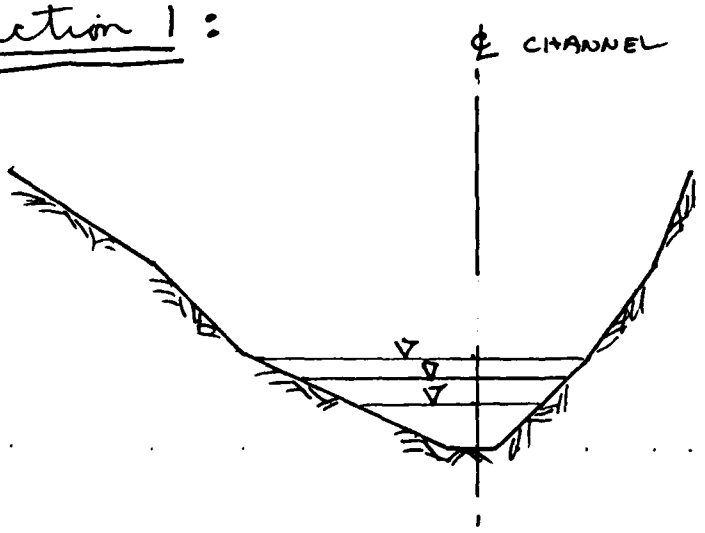


3. Bridge #3: Route 57



(F) Downstream Channel Flow vs. stage

Section 1:



1" = 200' HOR
1" = 20' VER

Calculate Q @ 5, 8, & 10 ft channel depths

Channel Slope = 30' ÷ 1000' = 0.03

Manning n = 0.05

a) Depth = 5 ft

Top width = 200 ft

Area = $\frac{5 \times 200}{2}$ = 500 ft^2

hyd. rad. = 500 ft^2 ÷ 210 = 2.3

Vel = 9.2 FPS

Q = 9.2 × 500 = 4,600 CFS

b) Depth = 10 ft

Top Width = 350 ft

Area = $\frac{10 \times 350}{2}$ = 1750 FT^2

hyd. rad = 1750 ÷ 360 = 4.9

Vel = 15 FPS

Q = 15 × 1750 = 26,300 CFS

c) Depth = 8 ft

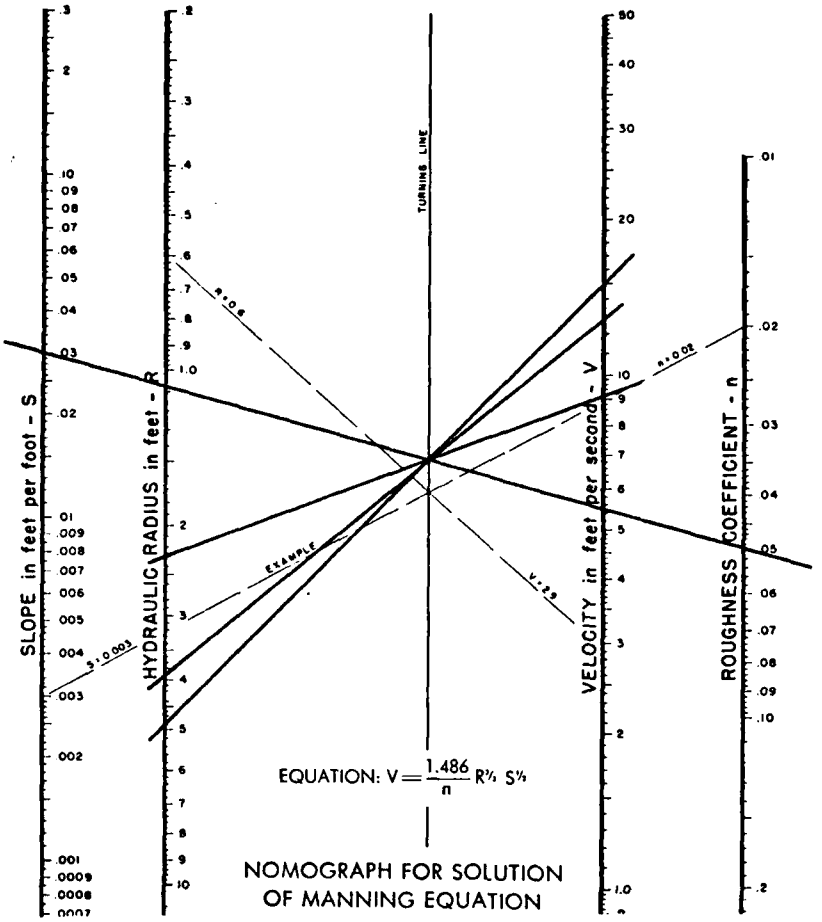
Top Width = 290 ft

Area = $\frac{8 \times 290}{2}$ = 1160 FT^2

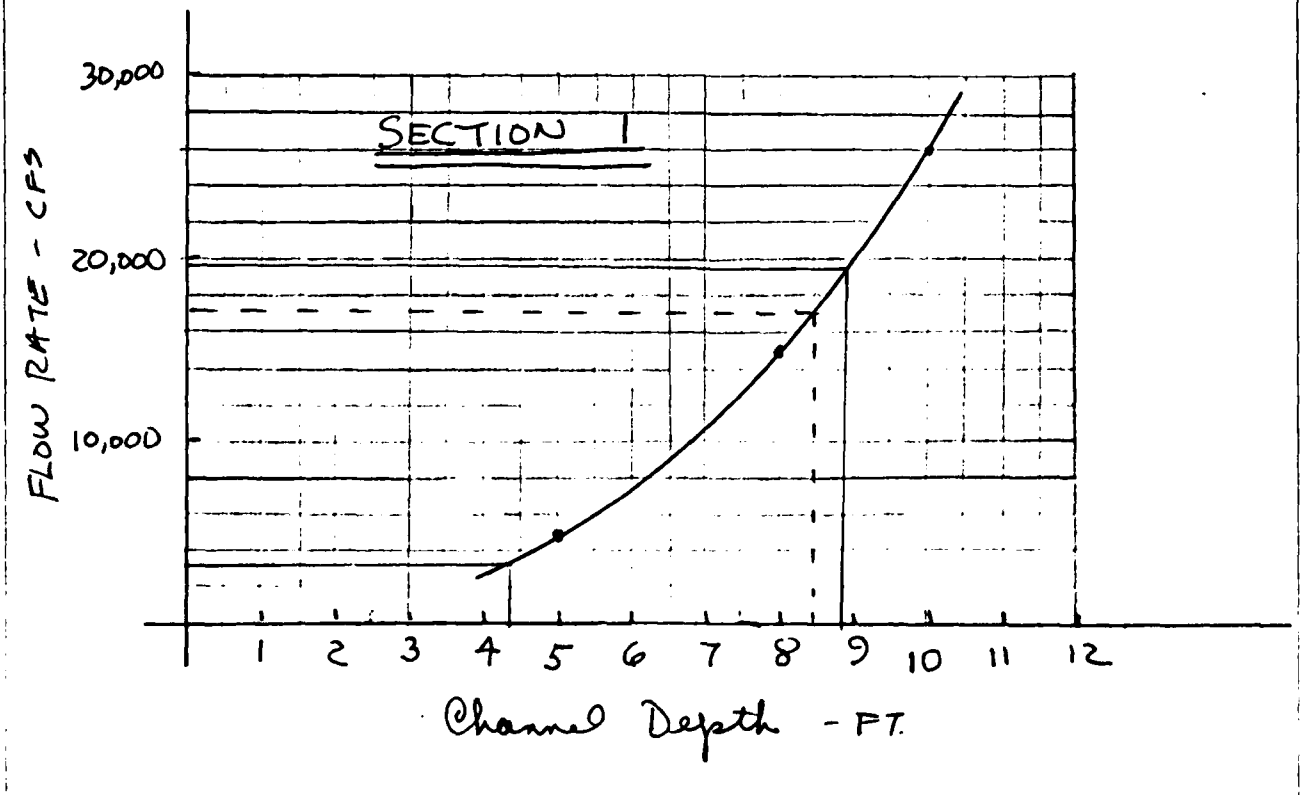
hyd. rad. = 1160 ÷ 300 = 3.9

Vel = 13 FPS

Q = 13 × 1160 = 15,000 CFS.



NOMOGRAPH FOR SOLUTION OF MANNING EQUATION



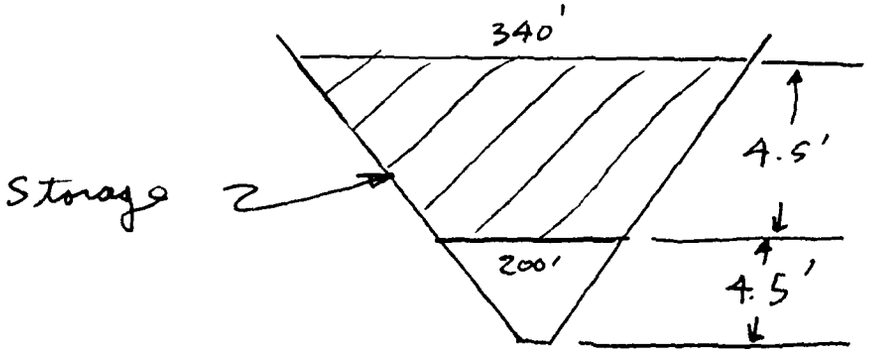
Test Flood outflow before failure = 2900 CFS
River stage = 4.5 ft

Dam Failure Flow = 19,650 CFS
River stage = 9 ft

Dampening Due To Upstream Reach:

Depth = 9 ft
Top Width = 340 ft
Reach Length = 4,300 ft

Before Failure depth = 4.5 ft
Top width = 200 ft



$$\text{Storage} = \frac{\frac{200+340}{2} \times 4.5 \times 4300}{43{,}560 \text{ ft}^3/\text{acre-ft}} = 119 \text{ acre-ft}$$

$Q_{p2\ TRIAL} = 19{,}650\left(1 - \frac{119}{889}\right) = 17{,}000$ CFS

@ 17,000 CFS : Depth = 8 ft

Top Width = 290 ft

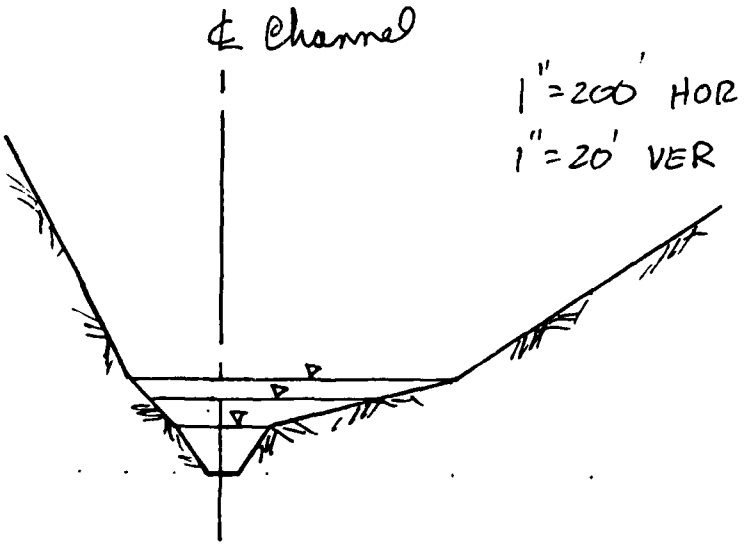
$$\text{Storage} = \frac{\frac{290+200}{2} \times 3.5 \times 4300}{43{,}560} = 85 \text{ acre-ft}$$

$$\text{Average Storage} = \frac{119+85}{2} = 102 \text{ acre-ft}$$

$$Q_{p2} = 19{,}650\left(1 - \frac{102}{889}\right) = 17{,}400 \text{ CFS}$$

∴ Outflow ~~to~~ reach #2 = 17,400 CFS

Section 2 :



Channel Slope = 20' ÷ 800 ft = 0.025

a) Depth = 5 ft

Top width = 100 ft

Area = $\frac{5 \times 100}{2}$ = 250 ft²

hyd. rad = 250 ÷ 110 = 2.3

Vel = 8.2 FPS

Q = 8.2 × 250 = 2050 CFS

b) Depth = 8 ft

Top width = 240 ft

Area = $\frac{8 \times 240}{2}$ = 960 ft²

hyd. rad = 960 ÷ 250 = 3.8

Vel = 11.5 FPS

Q = 11.5 × 960 = 11,000 CFS

c) Depth = 10 ft

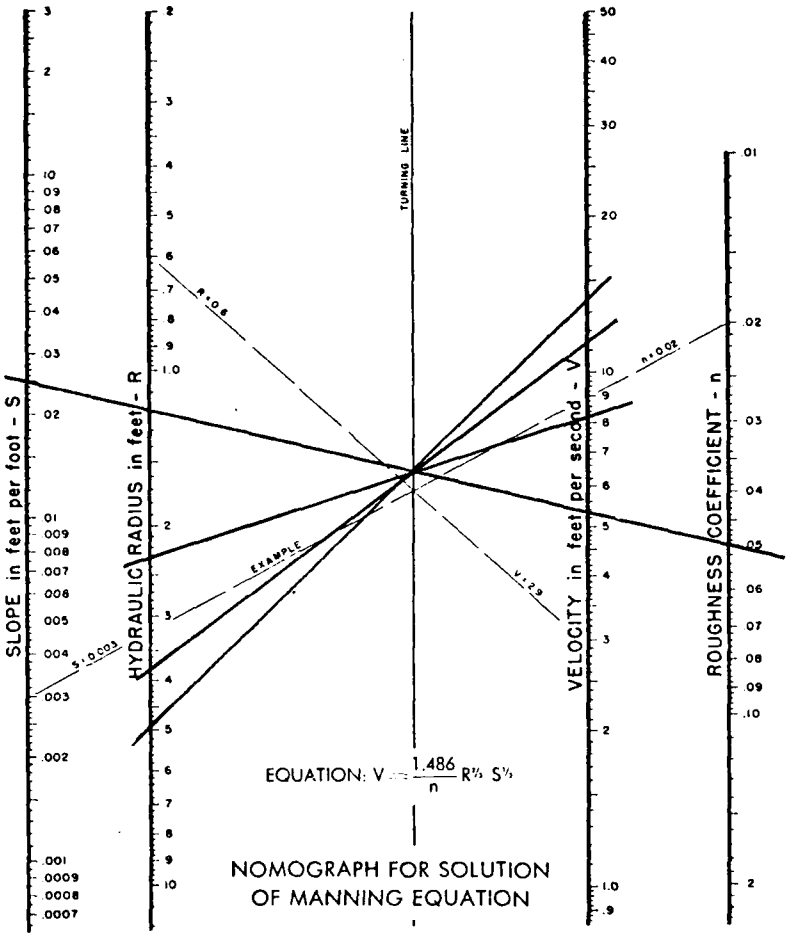
Top width = 350 ft

Area = $\frac{10 \times 350}{2}$ = 1750 ft²

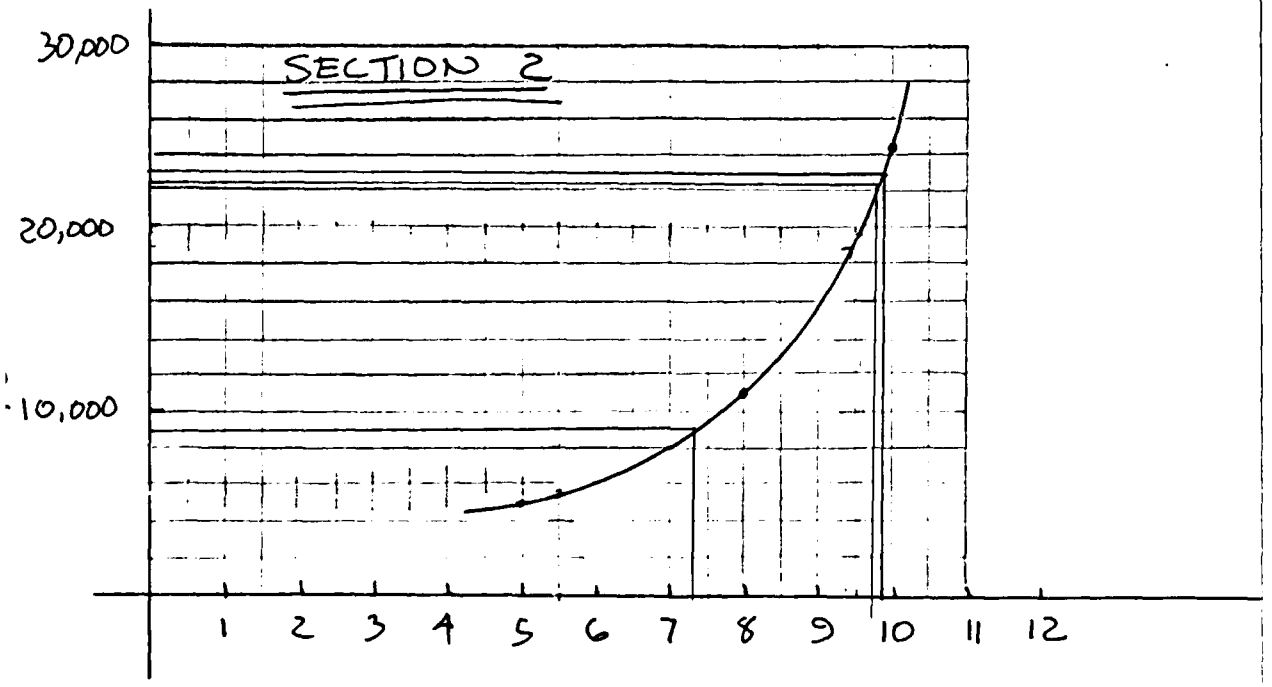
hyd. rad = 1750 ÷ 360 = 4.9

Vel = 14 FPS

Q = 14 × 1750 = 24,500 CFS



NOMOGRAPH FOR SOLUTION
OF MANNING EQUATION

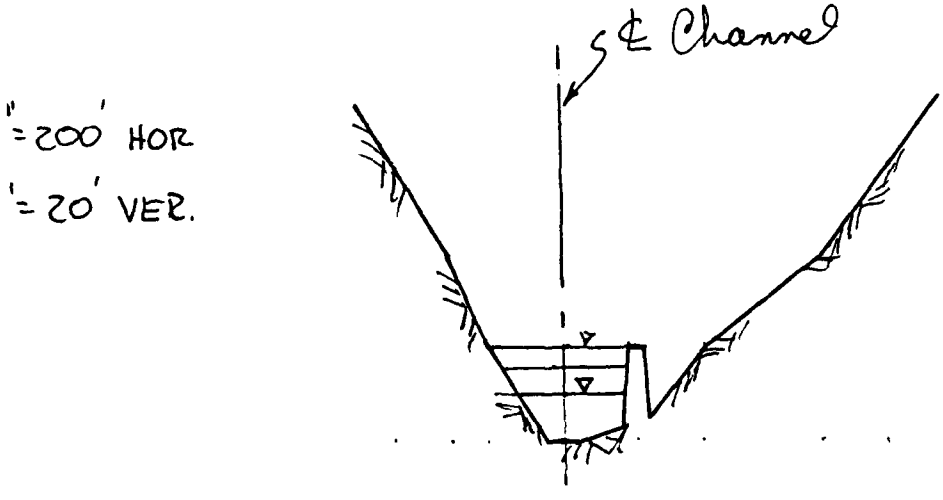


Average Storage = $\frac{34+35}{2}$ = 34.5 acre-ft

$Q_{PL} = 23{,}100 \left(1 - \frac{34.5}{889}\right) = 22{,}200$ CFS

∴ Outflow to reach #6 = 22,200 CFS

Section 6:



Channel slope = 20' ÷ 800' = 0.025

a) Depth = 5 ft

Top Width = 115 FT.

Area = $\frac{70+115}{2} \times 5 = 463$ FT^2

hyd. rad = 463 ÷ 125 ft = 3.7

Vel = 11.5 FPS

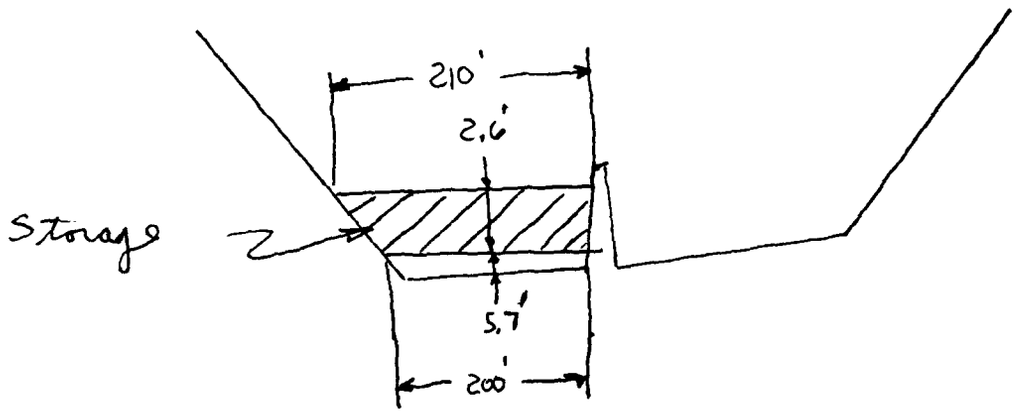
Q = 11.5 × 463 = 5,300 CFS

Test Flood Before Failure = 11,700 CFS

River Stage = 5.7 FT.

Dam Failure Flow = 23,100 CFS

River Stage = 8.3 FT.



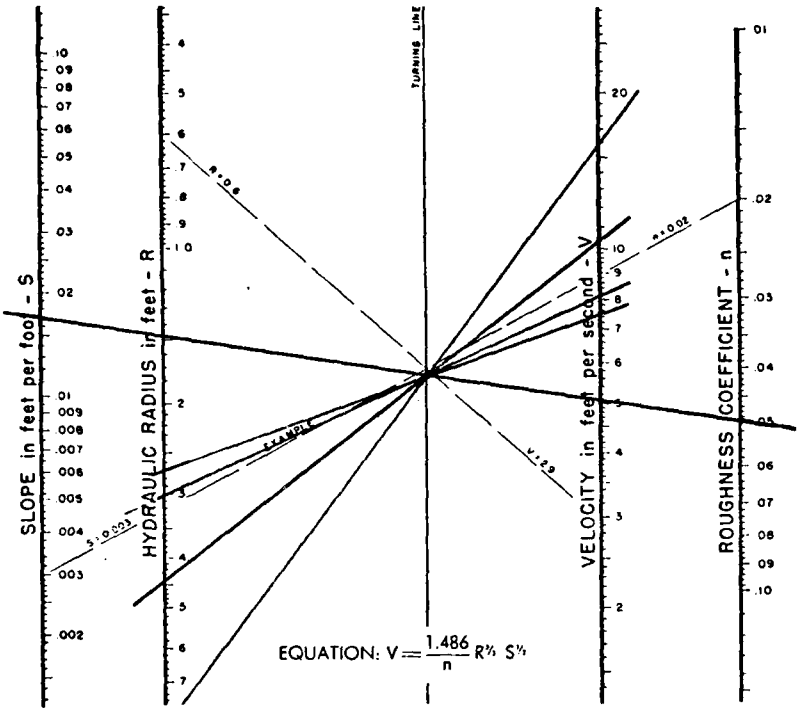
$$\text{Storage} = \frac{\frac{200+210}{2} \times 2.6 \times 2{,}900}{43{,}560} = 35 \text{ acre-ft}$$

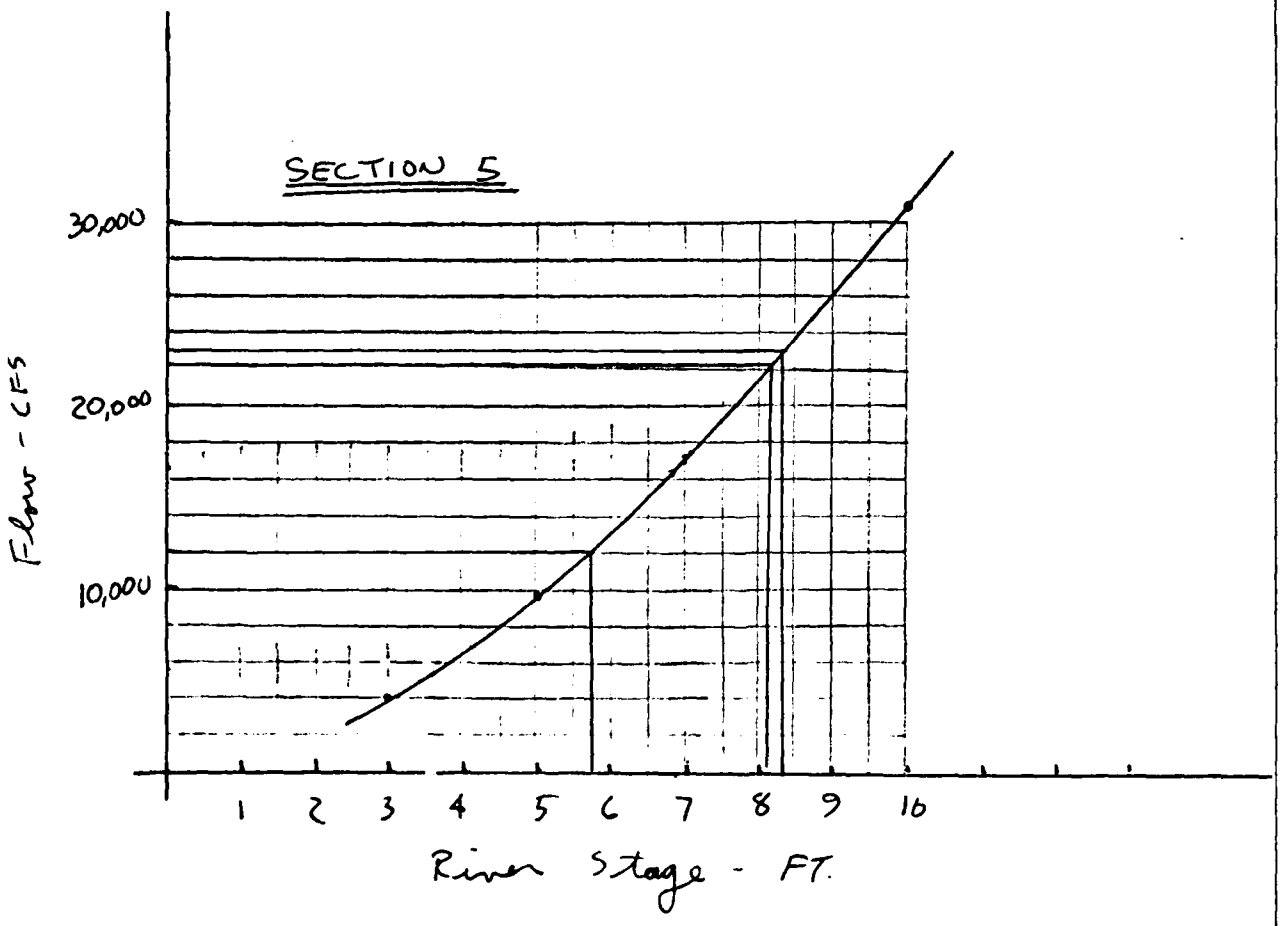
$$Q_{PG\ TRIAL} = 23{,}100 \left(1 - \frac{35}{859}\right) = 22{,}200 \text{ CFS}$$

@ 22,200 CFS = Depth = 8.2 ft

Top Width = 208 ft

$$\text{Storage} = \frac{\frac{200+208}{2} \times 2.5 \times 2900}{43{,}560} = 34 \text{ acre-ft}$$


SLOPE in feet per foot - S
HYDRAULIC RADIUS in feet - R
TURNING LINE
VELOCITY in feet per second - V
ROUGHNESS COEFFICIENT - n
EXAMPLE
EQUATION: $V = \frac{1.486}{n} R^{2/3} S^{1/2}$


SECTION 5
30,000
20,000
10,000
Flow - CFS
1
2
3
4
5
6
7
8
9
10
River Stage - FT.

. a) Depth = 5 ft

Top Width = 200 ft

Area = $\frac{170+200}{2} \times 5 = 925$ FT^2

hyd. rad = 925 ÷ 210 = 4.4.

Vel = 10.5 FPS

Q = 10.5 × 925 = 9,700 CFS

b) Depth = 3 ft

Top Width = 185 FT.

Area = $\frac{185+170}{2} \times 3 = 532$ FT^2

hyd. rad. = 532 ÷ 195 = 2,7

Vel = 7.5 FPS

Q = 7.5 × 532 = 4000 CFS

c) Depth = 10 ft

Top Width = 220 ft

Area = $\frac{220+170}{2} \times 10 = 1950$ FT^2

hyd rad = 1950 ÷ 230 = 8.5

Vel = 16 FPS

Q = 16 × 1950 = 31,200 CFS

$Q_{P5\ TRIAL} = 24{,}200\left(1 - \frac{42}{889}\right) = 23{,}100\ CFS$

@ 23,100 CFS : Depth = 4.8 ft
Top Width = 410 ft

$\text{Storage} = \frac{\frac{400+410}{2} \times 2.6 \times 1600}{43{,}560} = 39\ \text{acre-ft}$

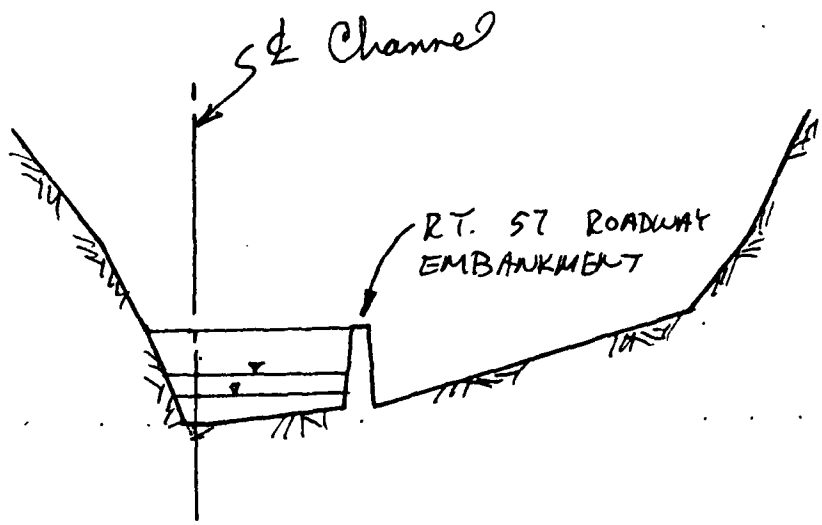
$\text{Average Storage} = \frac{42+39}{2} = 40.5\ \text{acre-ft}$

$Q_{P5} = 24{,}200\left(1 - \frac{40.5}{889}\right) = 23{,}100\ CFS$

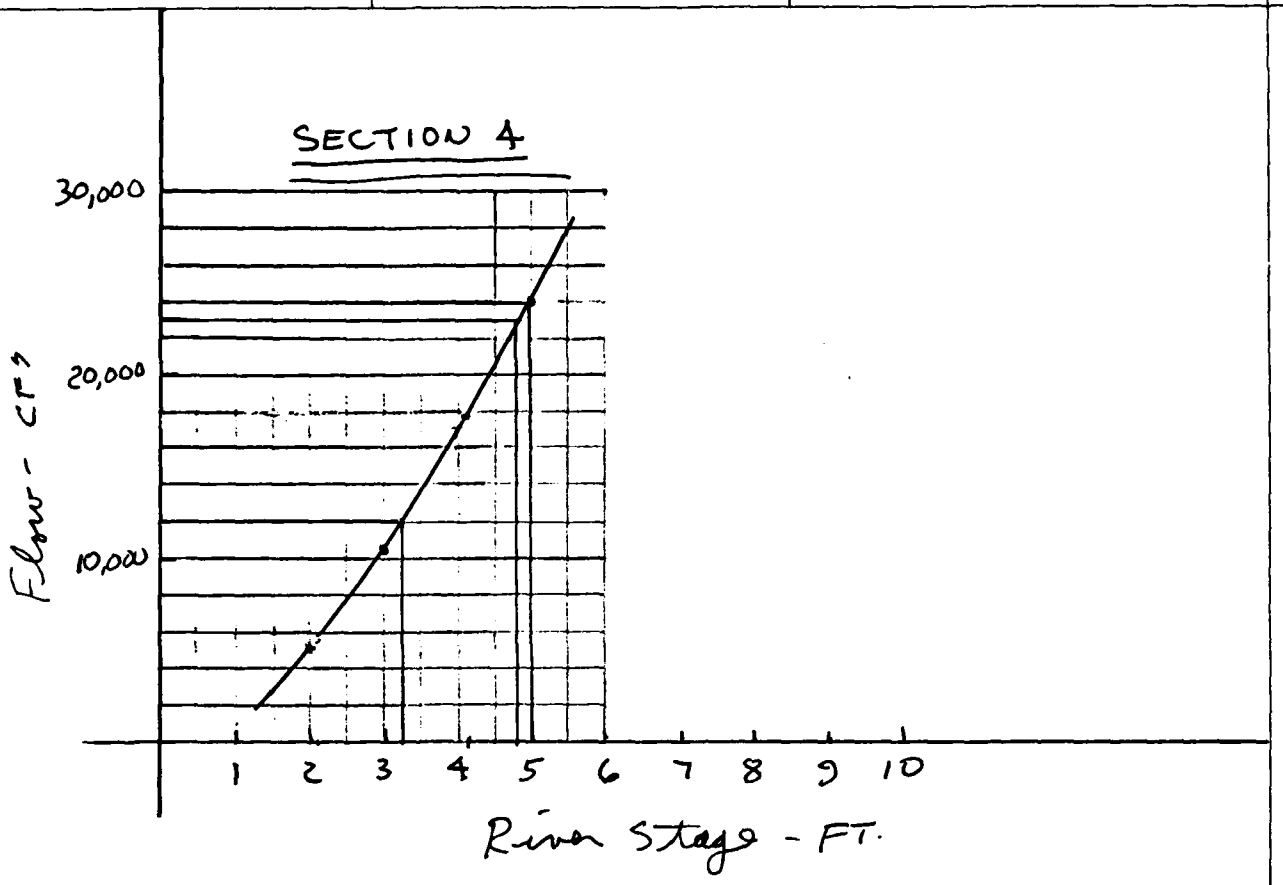
∴ Outflow to reach #5 = 23,100 CFS

Section 5 :

1" = 200' HOR
1" = 20' VER



Channel Slope = 20' ÷ 1200 = 0.017

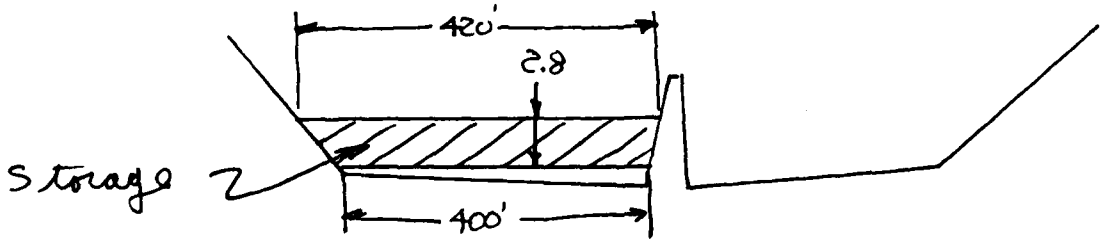


Test Flood Flow before failure = 8,700 CFS
*Tributary Confluence Flow = 3000 CFS
11,750 CFS

River Stage = 3.2 ft

Dam Failure Flow = 21,200 CFS
*Tributary Confluence Flow = 3,000
24,200 CFS

River Stage = 5.0 ft.



$$\text{Storage} = \frac{\frac{400+420}{2} \times 2.8 \times 1600}{43,560} = 42 \text{ acre-ft}$$

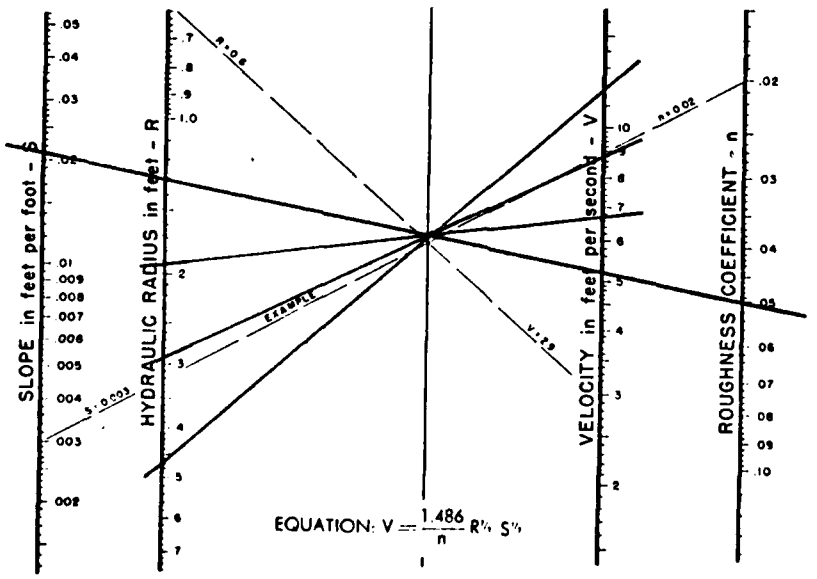
* See Calcs section (H), part 3

b) Depth = 3 ft
Top Width = 400 ft
Area = $\frac{390+400}{2} \times 3 = 1185$ FT²

hyd. rad = 1185 ÷ 410 = 2.9
Vel = 8.8 FPS
Q = 8.8 × 1185 = 10,400 CFS

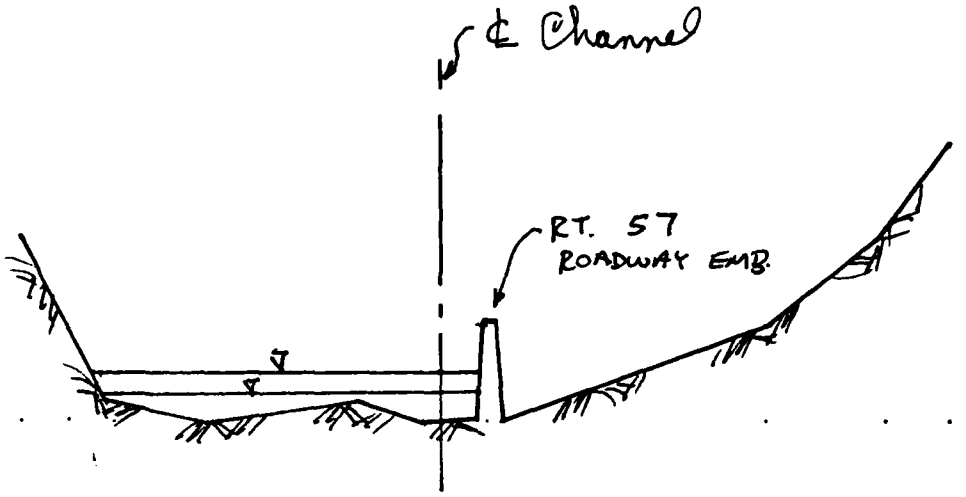
c) Depth = 2 ft
Top Width = 395 ft
Area = $\frac{390+395}{2} \times 2 = 785$ FT²

hyd. rad. = 785 ÷ 405 = 1.9
Vel = 6.7 FPS
Q = 6.7 × 785 = 5,300 CFS.



Section 4:

1" = 200' HOR
1" = 20' VER.



Channel Slope : 20' ÷ 950' = 0.021

a) Depth = 5 ft
Top Width = 420 ft
Area = $\frac{390+420}{2} \times 5$ = 2000 ft²

hyd. rad = 2000 ÷ 430 = 4.7
Vel = 12 FPS
Q = 12 × 2000 = 24,000 CFS

$$\text{Storage} = \frac{\frac{180 + 290}{2} \times 3.2 \times 2900}{43{,}560} = 50 \text{ acre-ft}$$

$$Q_{P4\ TRIAL} = 22{,}400\left(1 - \frac{50}{889}\right) = 21{,}100$$

@ 21,100 CFS : Depth = 14.3 ft

Top Width = 285 ft

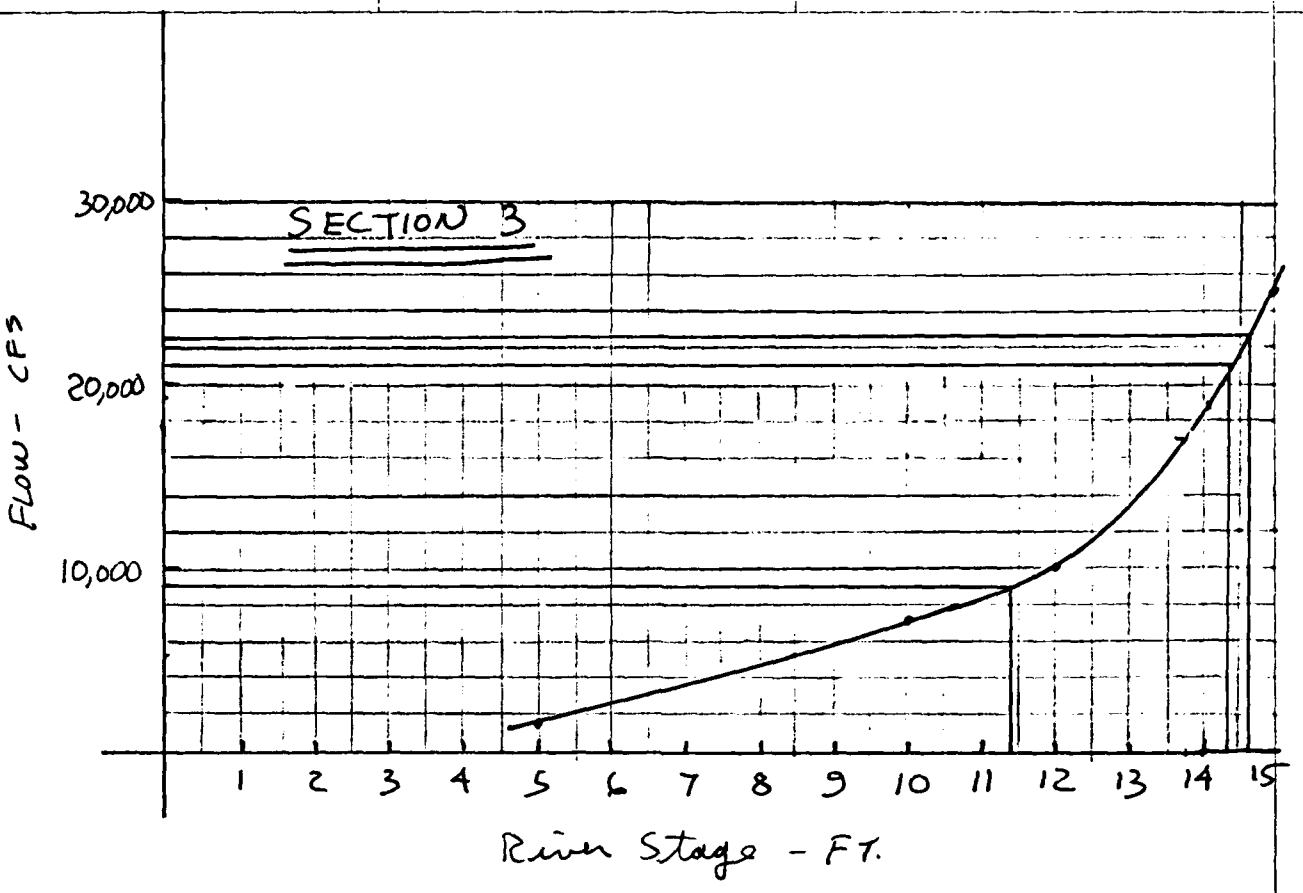
$$\text{Storage} = \frac{\frac{180+285}{2} \times 2.9 \times 2900}{43{,}560} = 45 \text{ acre-ft}$$

$$\text{Average Storage} = \frac{50+45}{2} = 47.50 \text{ acre-ft}$$

$$Q_{P4} = 22{,}400\left(1 - \frac{47.5}{889}\right) = 21{,}200 \text{ CFS}$$

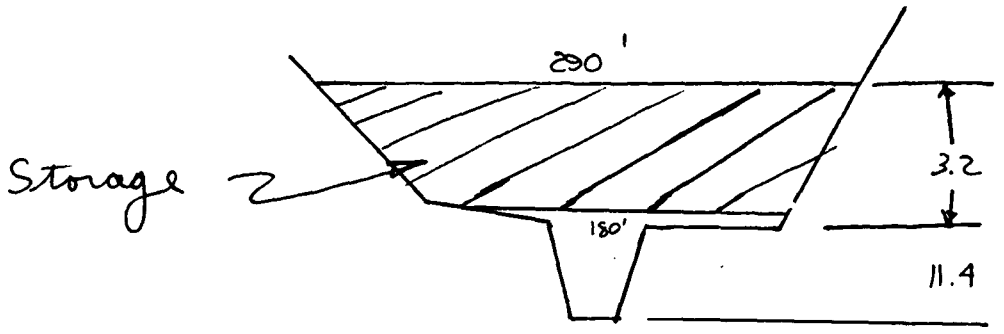
∴ Outflow to reach # 4 = 21,200 CFS

OHD 2/4/80



Test Flood flow before failure 8700 CFS
River Stage = 11.4 ft

Dam Failure Flow = 22,400 CFS
River Stage = 14.6 ft



D) Depth = 15 ft

Top Width = 290 ft

Area = $400 + \left(\frac{150+290}{2} \times 5\right) = 1500\ FT^2$

hyd. rad = 1500 ÷ 300 = 5

Vel = 17 FPS

Q = 17 × 1500 = 25,500 CFS

E) Depth = 18 ft

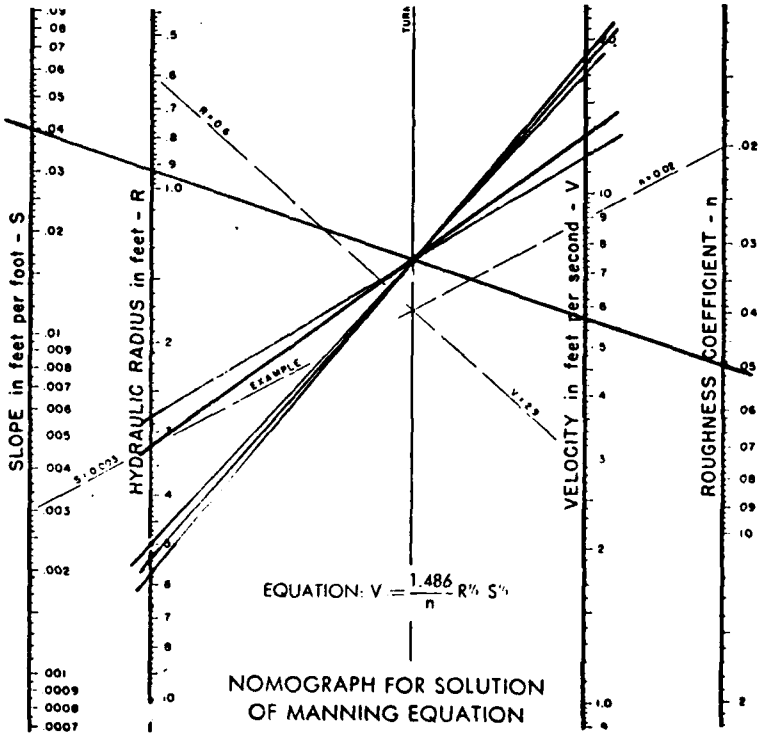
Top Width = 350 ft

Area = $400 + \left(\frac{150+350}{2} \times 8\right) = 2400\ FT^2$

hyd. rad = 2400 ÷ 360 = 6.7

Vel = 19 FPS

Q = 19 × 2400 = 45,600 CFS



NOMOGRAPH FOR SOLUTION OF MANNING EQUATION

a) Depth = 5 ft

Top Width = 50 ft

Area = $\frac{10+50}{2} \times 5 = 150\ FT^2$

hyd. rad = 150 ÷ 52 = 2.8

Vel = 12 FPS

Q = 12 × 150 = 1800 CFS

b) Depth = 10 ft

Top Width = 70 ft

Area = $\frac{10+70}{2} \times 10 = 400\ FT^2$

hyd. rad = 400 ÷ 74 = 5.4

Vel = 18 FPS

Q = 18 × 400 = 7,200 CFS

c) Depth = 12 ft

Top Width = 220 ft

Area = $400 + \left(\frac{150+220}{2} \times 2\right) = 770\ ft^2$

hyd rad = 770 ÷ 230 = 3.4

Vel = 13 FPS

Q = 13 × 770 = 10,000 CFS

$Q_{P3\ TRIAL} = 23{,}200 \left(1 - \frac{31}{889}\right) = 22{,}400$ CFS

@ 22,400 CFS : Depth = 9.7 ft

Top Width = 345 ft

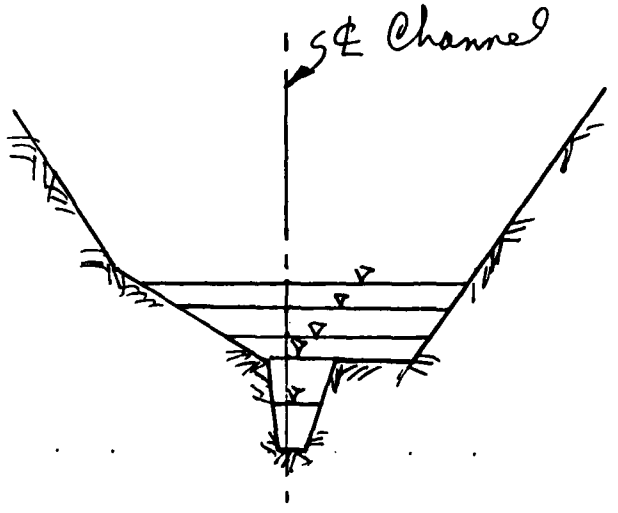
$$\text{Storage} = \frac{\frac{170 + 345}{2} \times 2.4 \times 2100}{43{,}560} = 30 \text{ acre-ft}$$

Average Storage $= \frac{30 + 31}{2} = 30.5$ acre-ft

$Q_{P3} = 23{,}200 \left(1 - \frac{30.5}{889}\right) = 22{,}400$ CFS

∴ Outflow to reach #3 = 22,400 CFS

Section 3:



1" = 200' HOR
1" = 20' VER

Channel Slope = 20' ÷ 500' = 0.04

Test Flood outflow before failure = 2900 CFS

* Tributary confluence flow = 5800 CFS

8700 CFS

River stage = 7.3 ft

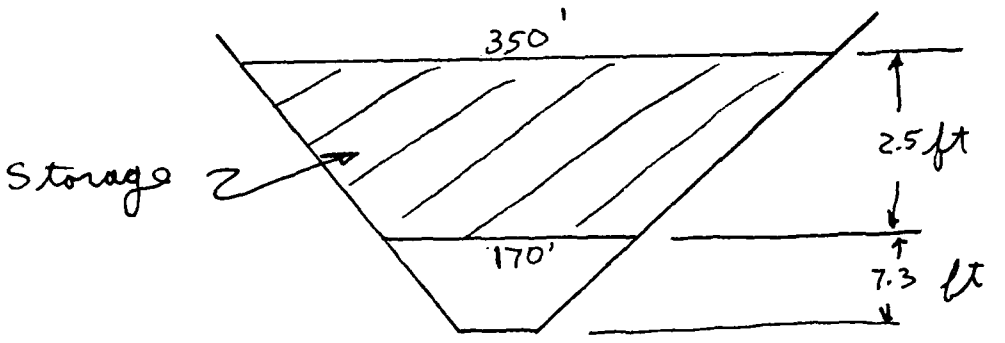
Dam Failure Flow = 17,400 CFS

Tributary confluence flow = 5800 CFS

23,200 CFS

River stage = 9.8 ft

Dampening Due To Upstream Reach Between Sections 1 & 2 :



$$\text{Storage} = \frac{\frac{170+350}{2} \times 2.5 \times 2100}{43{,}560} = 31 \text{ acre-ft}$$

* See calcs section (H), part 3

b) Depth = 10 ft

Top Width = 150 ft

Area = $\frac{70+150}{2} \times 10 = 1100\ FT^2$

hyd. rad = 1100 ÷ 160 = 6.9

Vel = 17 FPS

Q = 17 × 1100 = 18,700 CFS

c) Depth = 8 ft

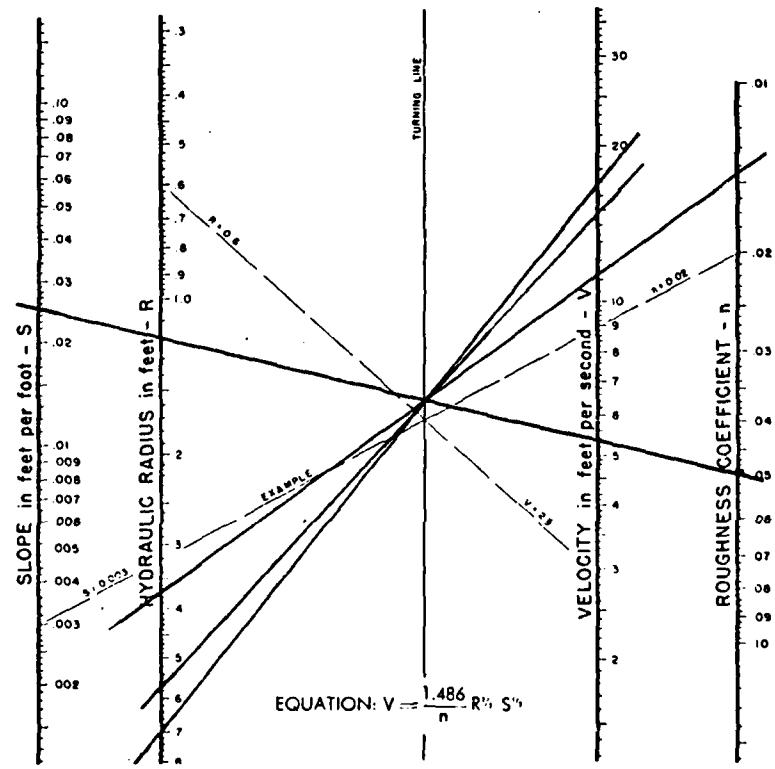
Top Width = 135 ft

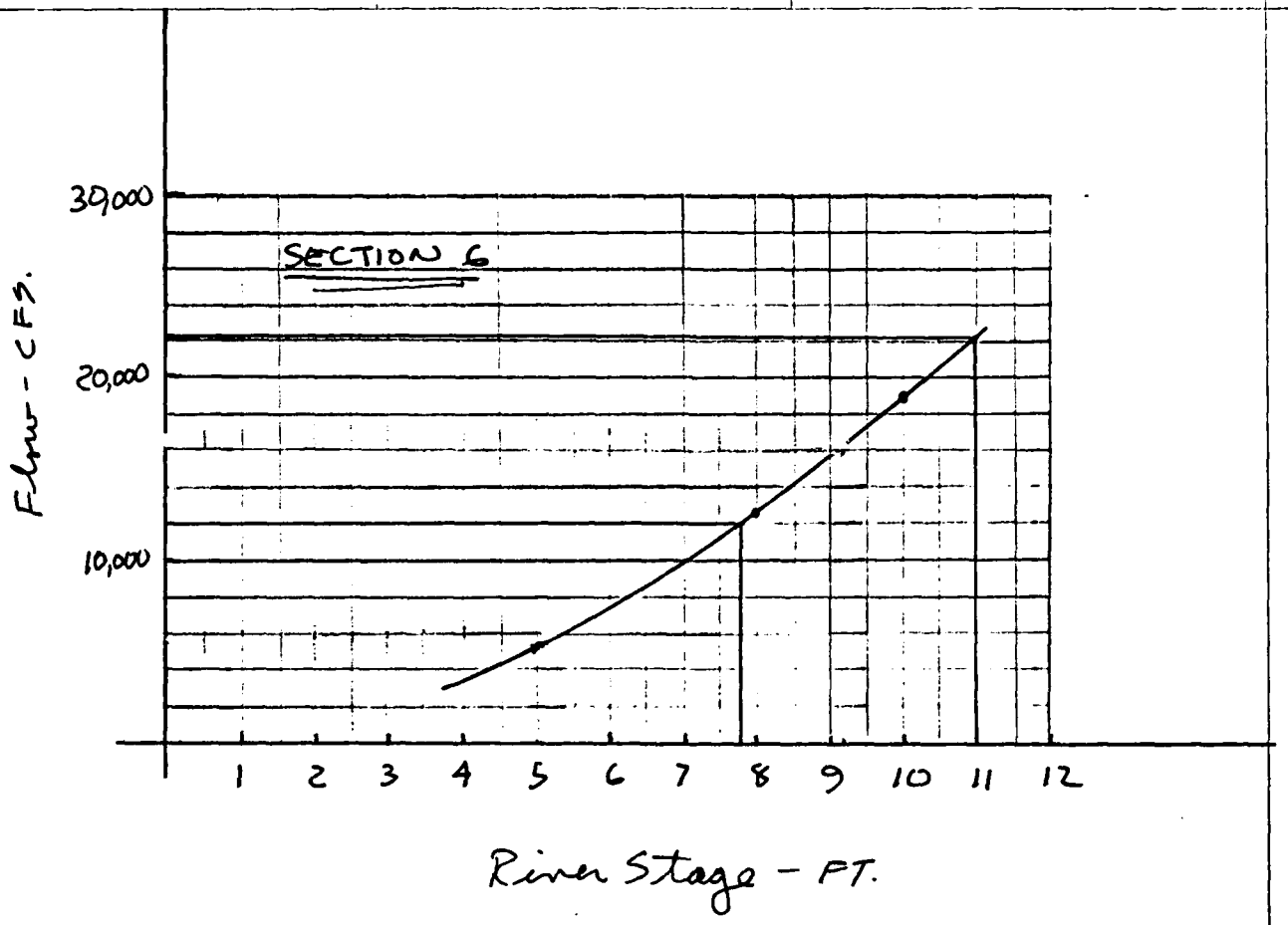
Area = $\frac{70+135}{2} \times 8 = 820\ FT^2$

hyd. rad. = 820 ÷ 145 = 5.7

Vel = 15 FPS

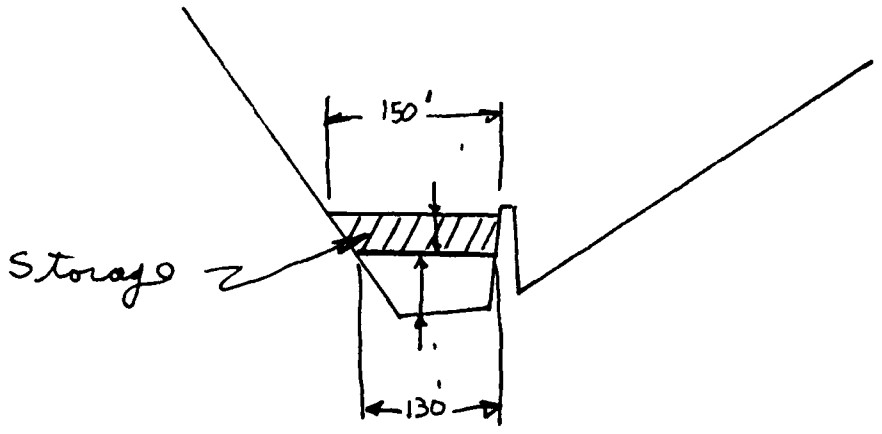
Q = 15 × 820 = 12,300 CFS





Test Flood Before Failure = 11,700 CFS
River Stage = 7.8 ft

Dam Failure Flow = 22,200 CFS
River Stage = 11.0 ft



D

$$\text{Storage} = \frac{\frac{130 + 150}{2} \times 3.2 \times 900}{43{,}560} = 9 \text{ acre-ft}$$

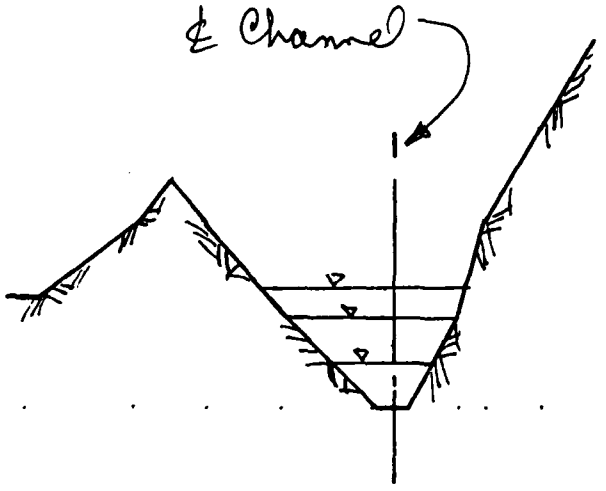
$Q_{P7\ TRIAL} = 22{,}200 \left(1 - \frac{9}{889}\right) = 22{,}000$ CFS

Averaging Storage will have negligible effect.

$\therefore Q_{P7} = 22{,}000$ CFS

Outflow to Reach # 7 = 22,000 CFS

Section 7 :



1" = 200' HOR
1" = 20' VER.

Channel Slope = 30' ÷ 1100' = 0.027

a) Depth = 5 ft
Top Width = 110 ft
Area = $\frac{110 \times 5}{2}$ = 275 ft^2

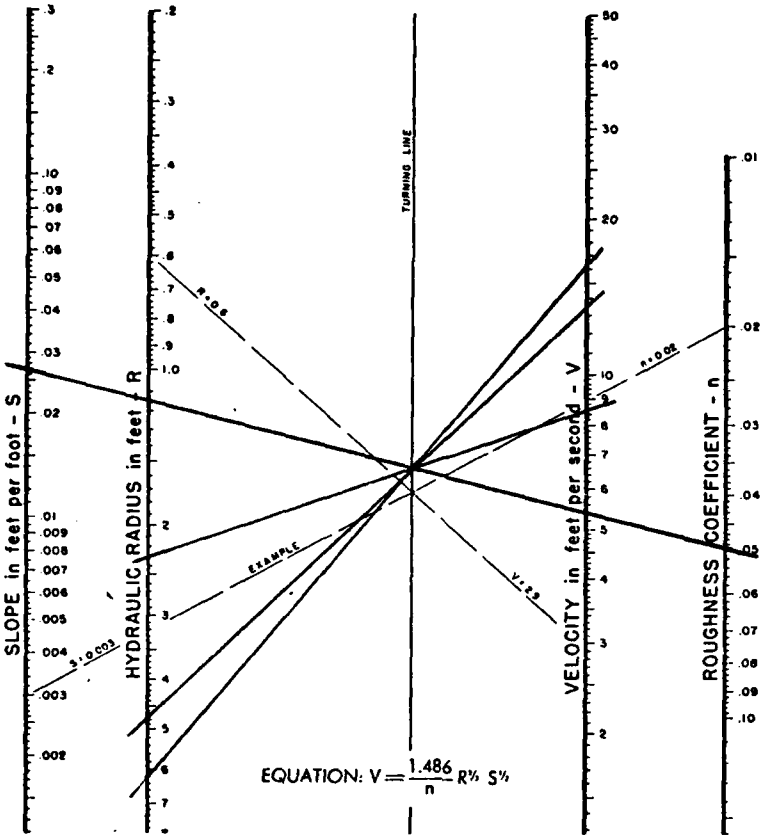
hyd. rad = 275 ÷ 120 = 2.3
Vel = 8.6 FPS
Q = 8.6 × 275 = 2400 CFS

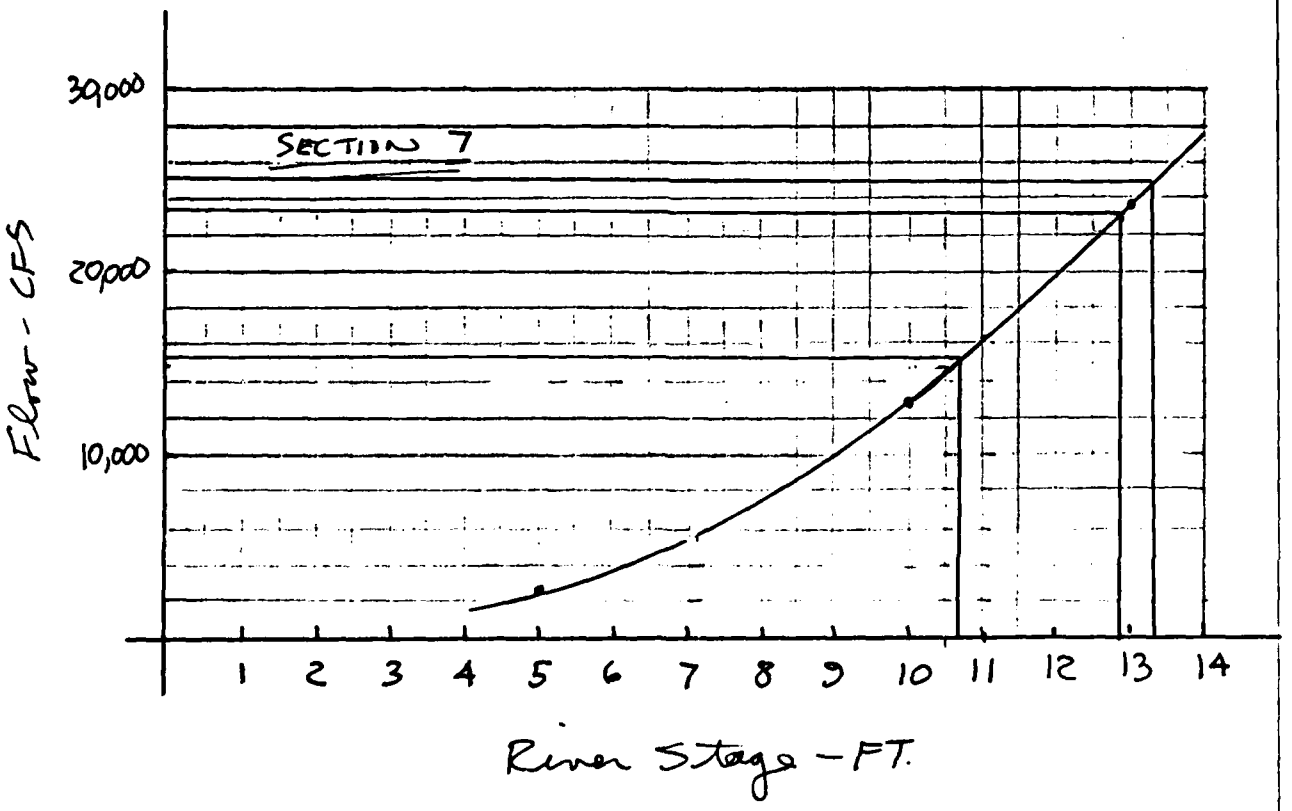
b) Depth = 10 ft
Top Width = 190 ft
Area = $\frac{190 \times 10}{2}$ = 950 FT^2

hyd. rad = 950 ÷ 200 = 4.75
Vel = 13.5 FPS
Q = 13.5 × 950 = 12,800 CFS

c) Depth = 13 ft
Top Width = 220 ft
Area = $\frac{220 \times 13}{2}$ = 1430 FT^2

hyd. rad = 1430 ÷ 230 = 6.2
Vel = 16.5 FPS
Q = 16.5 × 1430 = 23,600 CFS.


SLOPE in feet per foot - S
HYDRAULIC RADIUS in feet - R
TURNING LINE
VELOCITY in feet per second - V
ROUGHNESS COEFFICIENT - n
EXAMPLE
S=0.003
R=2.5
V=8.5
n=0.025
EQUATION: V = 1.486/n R^⅔ S^½


SECTION 7
30,000
20,000
10,000
Flow - CFS
1 2 3 4 5 6 7 8 9 10 11 12 13 14
River Stage - FT.

Test Flood Before Failure = 11,700 CFS

*Tributary Area Confluence = 2,900 CFS

14,600 CFS

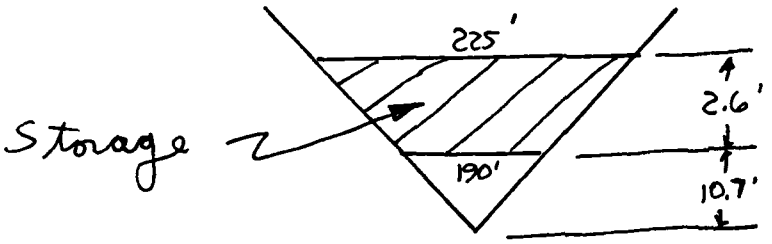
River Stage = 10.7 ft

Dam Failure Flow = 22,000 CFS

*Tributary Area Confluence = 2,900 CFS

24,900 CFS

River Stage = 13.3 ft



$$\text{Storage} = \frac{\frac{190+225}{2} \times 2.6' \times 5000'}{43{,}560} = 62 \text{ acre-ft}$$

$$Q_{P\&T\ TRIAL} = 24{,}900 \left(1 - \frac{62}{889}\right) = 23{,}200 \text{ CFS}$$

@ 23,200 CFS : Depth = 12.9 ft

Top Width = 220 ft

$$\text{Storage} = \frac{\frac{190+220}{2} \times 2.2 \times 5000}{43{,}560} = 52 \text{ acre-ft}$$

$$\text{Average Storage} = \frac{52+62}{2} = 57 \text{ acre-ft}$$

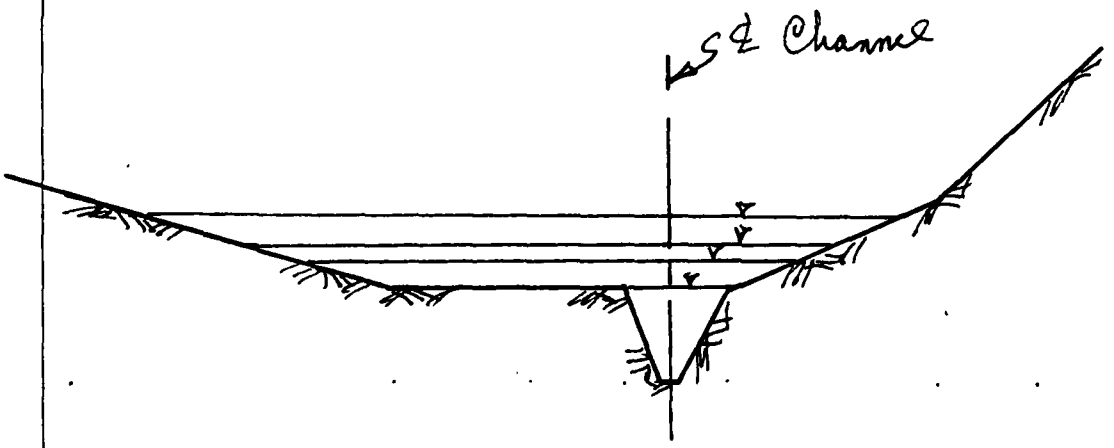
* See calcs section (H), part 3.

$$Q_{p8} = 24{,}900 \left(1 - \frac{57}{889}\right) = 23{,}300 \text{ CFS}$$

∴ Outflow to Reach #8 = 23,300 CFS

Confluence with Clam River Flow is just downstream of Section 7

Section 8:



Channel Slope = 20' ÷ 1000' = 0.02

a) Depth = 10 ft

Top width = 110 ft

Area = $\frac{110 \times 10}{2}$ = 550 FT^2

hyd. rad. = 550 ÷ 120 = 4.6

Vel = 11.5 FPS

Q = 11.5 × 550 = 6,300 CFS

b) Depth = 13 ft

Top Width = 520 ft

Area = 550 + $\left(\frac{320+520}{2} \times 3\right)$ = 1870 FT^2

hyd. rad. = 1870 ÷ 530 = 3.5

Vel = 9.8 FPS

Q = 9.8 × 1870 = 18,300 CFS

c) Depth = 18 ft

Top Width = 820 ft

Area = 550 + $\left(\frac{320+820}{2} \times 8\right)$ = 5270 FT^2

hyd. rad = 5270 ÷ 840 = 6.3

Vel = 14 FPS

Q = 14 × 5270 = 73,800 CFS

D) Depth = 15 ft

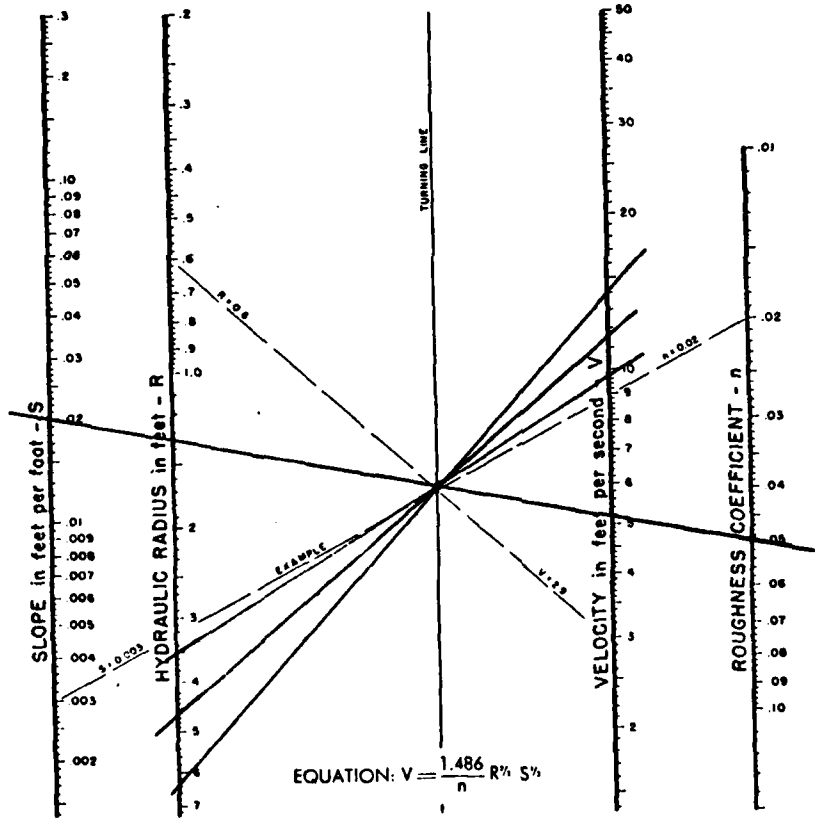
Top Width = 630 ft

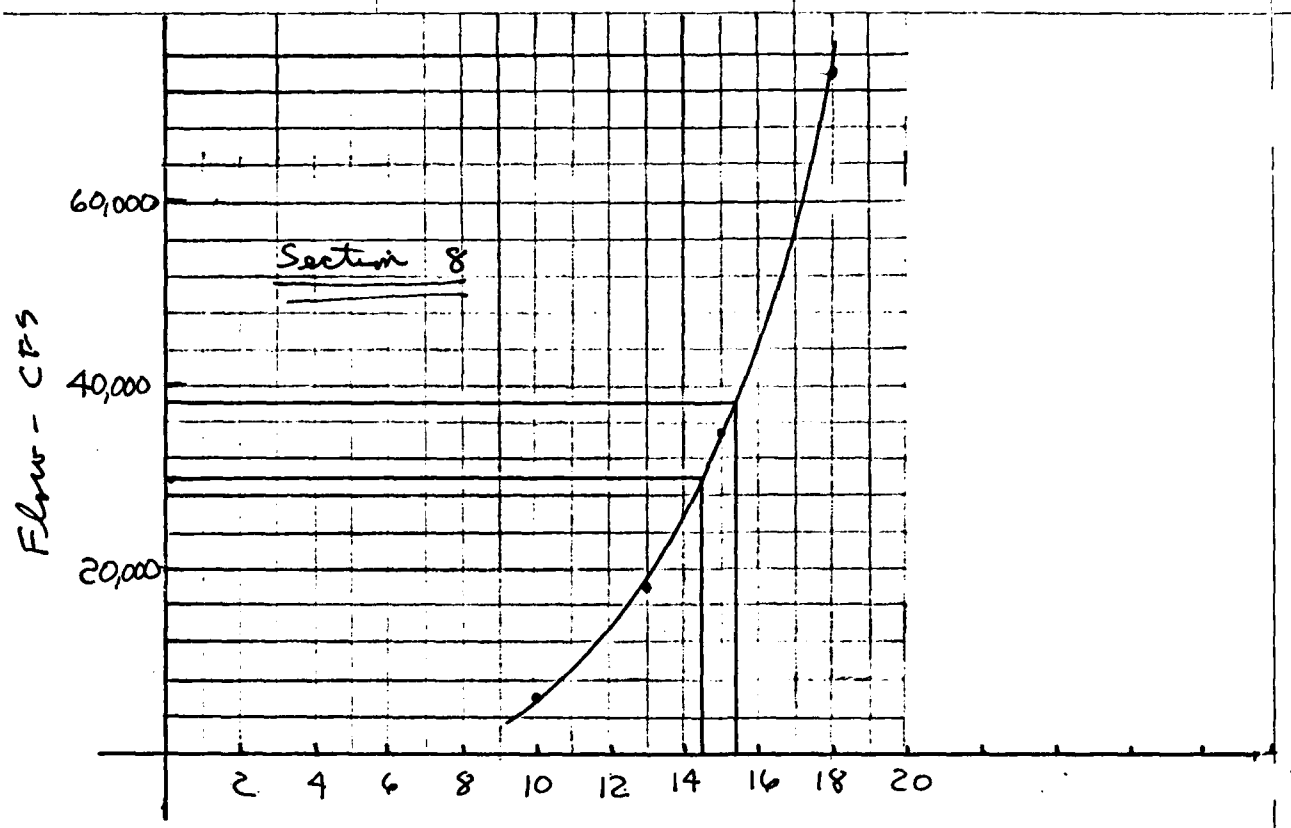
Area = $550 + \left(\frac{360+630}{2} \times 5\right) = 3025\ FT^2$

hyd. rad. = $3025 \div 650 = 4.7$

Vel = 11.5 FPS

Q = $11.5 \times 3025 = 34,800$ CFS





Test Flood Flow Before Failure : 14,600 CFS

*Clam River confluence MPF. 15,000 CFS

Total = 29,600 CFS

River Stage = 14.5 ft

Dam Failure Flow = 23,300 CFS

Clam River confluence MPF = 15,000. CFS

Total = 38,300 CFS

River Stage = 15.5 ft

* See calc section (H)

$$\frac{\text{After Dam Failure Flow}}{\text{Clam River MPF}} = \frac{38{,}300 \text{ CFS}}{29{,}600 \text{ CFS}} = 1.29\ \%$$

Confluence of Clam River & Farmington River @ New Boston:

D.A. = 92 mi^2 (includes Clam watershed)

ref: "Yield of Streams In Massachusetts"
By. G.R. Higgins

Per. COE guide curves: MPF = 1200 CFS/mi^2

MPF = 92 × 1200 = 110,400 CFS

$$\frac{\text{After Dam Failure Flow}}{\text{Farmington River MPF}} = \frac{38{,}300 \text{ CFS}}{110{,}400 \text{ CFS}} = 35\ \%$$

) Culvert Capacities :

$$H\text{-losses} = \frac{V^2}{2g}$$

losses = entrance, friction

losses = $0.5\frac{V^2}{2g} + 0.4\frac{V^2}{2g}$

losses = $0.9\frac{V^2}{2g}$

$$H - 0.9\frac{V^2}{2g} = \frac{V^2}{2g}$$

$$H = 1.9\frac{V^2}{2g} \quad ; \quad V^2 = \frac{2gH}{1.9}$$

$$V = \sqrt{\frac{2gH}{1.9}}$$

1. Box Culvert #1 @ West St.

Area = $7 \times 5.2 = 36.4\ FT^2$

Surcharged to Roadway H = 1.0 ft (due to tailwater)

$$V = \sqrt{\frac{(2)(32.2)(1.0)}{1.9}} = 5.8\ FPS$$

$$Q = 36.4 \times 5.8 = 212\ CFS$$

2 Box Culvert #2 @ West st

Area = $12' \times 7.2' = 86.4\ FT^2$

Surcharged to Roadway H = 2.8 ft due to tailwater

$$V = \sqrt{\frac{(2)(32.2)(2.8)}{1.9}} = 9.7\ FPS$$

$$Q = 9.7 \times 86.4 = 842\ CFS$$

3. Bridge #3 @ Route 57

Area = $35 \times 5 = 175\ FT^2$

Surcharged to Roadway H = 3 ft due to tailwater

$$V = \sqrt{\frac{(2)(32.2)(3)}{1.9}} = 10.1\ FPS$$

$$Q = 10.1 \times 175 = 1765\ CFS$$

Tributary Stream Flood Flows:

1. West Lake Flow:

D.A. = 1.46 mi^2
unit discharge = 2650 CFS/mi^2

Flood Flow = 3870 CFS inflow to reservoir

Flood water storage dampens the outflow from the reservoir to about 2500 CFS.

2. Clam River Flow:

D.A. at confluence = 14 mi^2
unit discharge = 1850 CFS/mi^2

Flood Flow = 26,300 CFS

Flood water storage at the Clam Dam, dampens the outflow from the flood protection reservoir to about 15,000 CFS.

3. Tributary Flow entering at Section 2

D.A. = West Lake + Abbey Lake + downstream to Section 2

D.A. = 1.46 + 1.75 + 2.0 = 5.21 mi^2

unit discharge = 2550 CFS/mi^2

Flood Flow = 5.21 × 2550 CFS/mi^2 = 11,600 CFS

West & Abbey will dampen the flood flow to about 8700 CFS.

4. Tributary Flow entering at Section 4

D.A. = West Lake + Abbey Lake + downstream to Section 4.

D.A. = 1.46 + 1.75 + 3.76 = 6.97 mi^2

unit discharge = 2100 CFS/mi^2

Flood Flow = 6.97 × 2100 = 14,600 CFS

Dampened Flow due to West & Abbey = 11,700 CFS.

5. Tributary Flow entering at Section 7

D.A. = West + Abbey + D.S. to section 7.

D.A. = 1.46 + 1.75 + 5.32 mi^2 = 8.53 mi^2

unit discharge = 2050 CFS/mi^2

Flood Flow = 8.53 × 2050 = 17,500 CFS

Dampened Flow due to West & Abbey = 14,600 CFS.

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

END

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